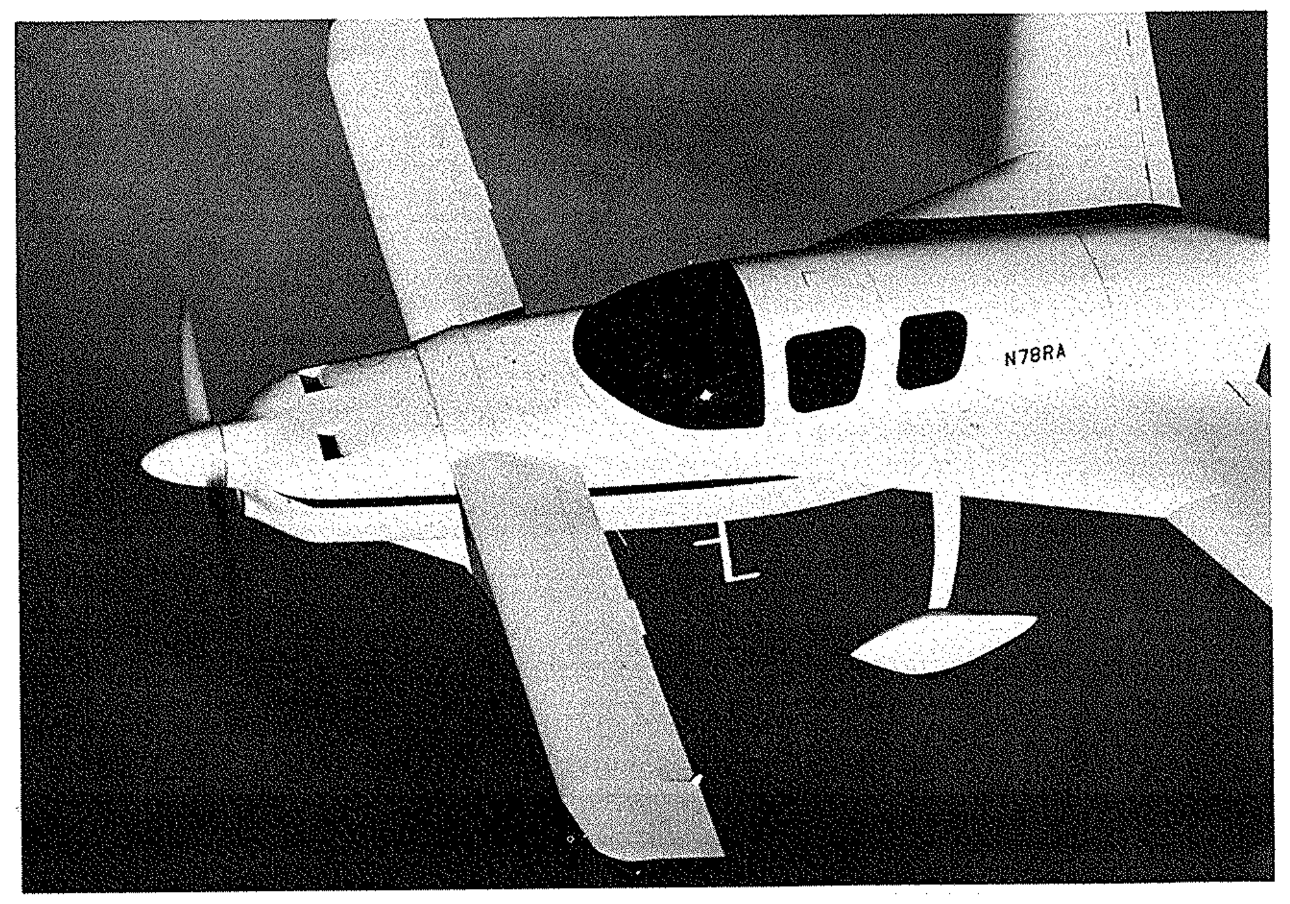
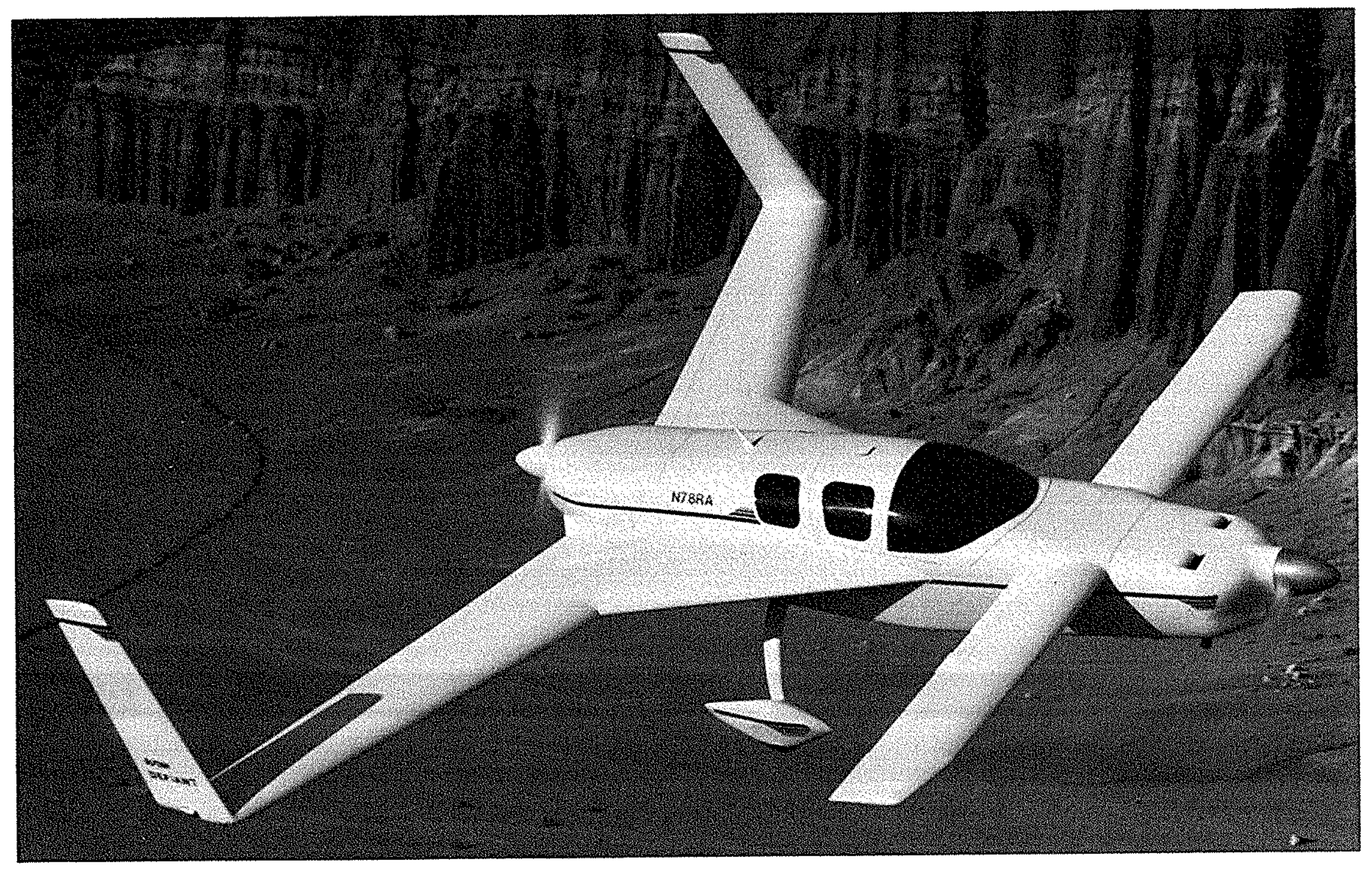
Defiant

Section 1



Airframe Construction Plans



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This set of plans contains all of the information necessary to manufacture a Defiant airframe. These plans include a basic education on the use of composite materials for aircraft construction, 580 photographs of the building sequence, all of the necessary full size templates, patterns and jig drawings and the method used to finish the composite aircraft.

Section II - DEFIANT ENGINE INSTALLATION

This section contains the information necessary to build and install the engine mounts, the Lycoming engines, baffling engine controls, exhaust systems, engine instruments, propellers, spinners, induction and cowlings manufacture and installation. The electrical wiring diagram and the electric pitch trim system are also shown in this section.

DEFIANT OWNERS MANUAL

This is a basic flight and maintenance manual and it includes normal and emergency procedures, weight and balance information. Check lists, detailed flying qualities description and operating limitations. Performance charts, maiden flight test procedures, pilot checkout procedures and record keeping requirements are also included.

THE CANARD PUSHER NEWSLETTER

The CP is published four times a year and includes very important information that updates the plans, such as plans changes, builder hints and feedback from other builders.

NOTE: Sections I and II and a subscription to the Canard Pusher Newsletter, starting with CP #41 are mandatory to build a Defiant. The Owners Manual is required before you fly your Defiant.

WARNING - These plans are obsolete unless updated by newsletter #41 and on. Do not fail to do this as it is possible that mandatory flight safety improvements may occur.

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DESCRIPTION / INTRODUCTION

The Defiant is a high performance, "build it yourself" twin engine, land aircraft. Its compact external size results in superb peformance and economy using commonly available Lycoming aircraft engines from 150 to 180 horsepower. Inside, it provides comfort for up to four adults of 6'6" tall and up to 240 lbs each. The large baggage area of 16.5 cubic feet can handle normal suitcases up to a total of 200 lbs. With the optional fold down back seat, the baggage area/back seat area becomes a bed that can sleep two large adults in comfort or can be used to haul large volumes of baggage, up to 41 cubic feet.

The canard configuration is designed not only for superior performance but to provide improved flying qualities and safety as compared to conventional light twin engine aircraft. The "in-line engine layout provides centerline thrust and therefore there are no assymetrical power problems in the unfortunate event of an engine failure as the Defiant flies very well on one engine. The Defiant uses the latest aerodynamic features. It uses the NASA developed winglet system and modern airfoils optimized for this configuration.

The high lift canard wing has long, narrow flaps which double as elevator (pitch control) and landing flaps. The rear wing has conventional ailerons mounted inboard for control system simplicity and low adverse yaw. Yaw control is by conventional rudder pedals with toe brakes. The rudder is a separate surface, mounted below the floor under the rudder pedals. This results in a very simple control system that is also very light weight.

An electrically driven bungee pitch trim system is actuated by a small switch built into the forward engine throttle handle. Roll trim is provided by turning a small "wheel" in the appropriate direction on the left side of the cockpit. This "wheel" mechanically "splits" the elevators on the canard, which gives the desired lateral trim. Experience has shown that this control is not used very often, rather once correctly set, the aircraft flies wings level in almost all conditions. Yaw trim is provided by a small servo motor mounted in the rudder itself, which actuates a tiny trim tab on the trailing edge of the rudder.

The main landing gear is a one piece, molded unidirectional fiberglass strut extending from one axle to the other. The one piece design eliminates the excessive leverage loads found in conventional two piece gear legs. This allows a much lighter structural attachment to the fuselage. The strut is molded in an airfoil shape for low drag.

The strut is designed to enter at the top of the wheel pant, rather than at the side, to reduce interference drag. The cruise speed penalty due to the fixed main gear is only 9 knots. Thus the increase in empty weight, increased cost, increased complexity and maintenance of a retractable gear is not justified.

The nose gear is simply an "off the shelf" weldment from any model Mooney aircraft from 1954 to 1984. Some of these aircraft had 3 rubber donuts and some had 4. Some had a shock strut mounted on one side. The one on the prototype has 3 rubber donuts and a shock strut and was originally mounted on a 1965 Mooney, Model 205 Executive. Although there have been a few minor modifications over the years, the Model 205 and 231 Mooneys have essentially the same nose gear strut, without the shock strut. Fred Keller has removed the shock strut from his and has found absolutely no perceptible difference. The Defiant has positive nose wheel steering, as well as independent braking which allows tighter turns at low taxi speeds. The nose gear is retractable in flight, using a simple mechanical arm to raise it or lower it with a single, effortless stroke.

The fuel system consists of two, 50 gallon (approximate) glass/foam/glass composite fuel tanks which form wing strakes along the fuselage sides. These main tanks feed into two sump tanks located under the baggage area floor. These tanks each contain approximately 5 gallons. Each of these tanks contains a float switch which is used to turn on a low fuel level warning light on the panel. With the main tank visual fuel gauges, this fuel system is about as fool proof as possible. Normally the left main feeds the front engine and the right main feeds the rear. There is also crossfeed capability.

The canard and both main wings are removable which facilitates getting your Defiant to the airport and would allow compact storage. However, we do not recommend that this aircraft be routinely trailered to and from the airport.

The composite structure of your Defiant provides some important advantages over conventional metal, wood or fabric construction. It has been tested to loads far in excess of those required for FAA certification. Fatigue margins are higher. Contour is maintained under load, the structure does not "oil can" buckle or distort. It provides excellent insulation and damps out noise. It had no hidden joints, no water traps and is far less susceptible to corrosion. It is easier to inspect, more redundant and easier to repair. It is not susceptible to thermal stress due to temperature changes. Properly protected from ultra violet, it has a very long life.

DEFIANT PLANS

The format for these plans is new for Rutan Aircraft. Unlike plans for the VariEze, the Long-EZ and the Solitaire, these plans assume you have some previous composite aircraft building experience. This section of the plans consists of five segments. The first 3 pages are prefixed with an 'A' and these 'A' pages cover a description/introduction to the Defiant, a table of contents, a parts list and the bill of materials.

The following 6 pages are prefixed with a 'B'. The 'B' pages contain the education section. This section should be carefully read several times before beginning construction. A good understanding of composite construction techniques is a mandatory requirement. These plans will not necessarily "lead you by the nose" so to speak. In many cases, as an example, you must decide when to use peel ply. You must decide how much to sand and when to sand. You must know to slurry all foam before laying up the glass.

The following 14 pages are prefixed with a 'C' and the 'C' pages consist of over 580 photos, which are roughly arranged in the recommended order of construction. This is your basic order of construction information. It may not necessarily be the only possible order of construction information. But we know that if you do follow this procedure, you will not "paint yourself into a corner". If you elect to change this order, you do so on your own. RAF cannot advise you on this, nor can we help you if you get into trouble by working out of order. If you must do this, we recommend that you carefully look ahead, and try as much as you can to foresee what you might run into. The only way to do this is to read, reread and become thoroughly familiar with every segment of these plans, until you have a good mental picture of exactly how you are going to do this thing. Be advised that we very strongly recommend that you follow exactly the building order as shown by the segment 'B' recommended order of building.

The photographs in segment 'C' each have a caption describing what you are seeing and referring to the appropriate drawings in the following 58 pages prefixed with a 'D'. The 'D' pages contain all of the drawings, sketches and full sized templates required to build a Defiant. In addition, these drawings contain the necessary layup schedule for each layup. (This is the only source of layup information) number of plies, orientation of each ply, and type of glass (BID or UND) will be found on the appropriate drawing pertaining to the part you may be building.

Lastly, in Section I are the 2 pages prefixed with an 'E'. The 'E' pages contain the information necessary to finish your Defiant. This is a very important segment and the criterior contained in the finishing segment must be carefully followed to ensure that you do not damage your structure and that your Defiant has good contours, a paint finish that not only looks good, but that will provide the necessary ultra violet protection for the structure and of course, that your beautiful paint finish will stay on the airplane.

In conclusion, the recommended method to use these plans is this: Carefully study each segment of Section I. Using the "Order of Building" and the parts list (Segment B), the photographs (Segment C), and the drawings (Segment D) to gain a full understanding. Refer to the table of contents and the bill of materials. All of the information required to build the Defiant airframe is contained in Section I. If a particular point does not seem immediately clear to you, do not just assume that the plans are wrong or that something has been omitted. Refer back and forth between all of the segments, carefully examine the drawings and all the words on or near the drawings. Check the photographs and their captions and generally your problem will solve itself.

Note that certain terminology is used throughout these plans. For example, layup numbers are found throughout the 'C' segment. The captions under the photographs call out layup numbers ①, ② etc. This is the order that the particular layup is to be done in. In the 'D' segment, the drawings contain this same information. Each drawing pertaining to layups, as an example, Page D-27 shows the layup schedule for the canard. The first layup is called out as ①. This goes on to detail what ① is. It tells you to layup two (2) plies of UND (unidirectional glass), the first at +45°, the second at -45°. This pair of plies is layed up from B.L.+110 to B.L.-110. That is to say that this layup will be 220 inches long. It will extend from a point 110 inches left of the canard centerline to a point 110 inches right of the canard centerline.

Occasionally in these plans you may see a particular material, such as PVC foam called out by color. As an example, on Page D-24 there is a call out for high density PVC foam, light red, 6lb/ft^3, type 100. This particular material is manufactured by Klegecel and is sometimes stocked by the distributors. You may receive PVC foam manufactured by Divinicel. It will be a tan color, not red but is perfectly ok to use in the Defiant.
Be very careful that you do indeed use the correct density foam, PVC or any other type for the particular application. It is the density that is important, not the color or the manufacturer.

PROSPECTIVE

The builder of an amateur built aircraft is the manufacturer. He is responsible for quality control on all parts, all construction, and the conduct of his flight tests. While Rutan Aircraft Factory Inc. is not the manufacturer of your aircraft, we do, through these plans and services, provide you with information about how our Defiant was built and how we feel is the best way for you to build a safe, reliable aircraft. We do encourage you to build the Defiant as shown in the plans because we have found that our aircraft provides us with reliability and safety. Any problems that we experience with our aircraft are documented and reported in the "Canard Pusher". We have gone to a considerable effort in developing the design, the structure and the systems and proving their adequacy with appropriate tests.

If you modify the aircraft and then ask us if your modification will work, we cannot give you an answer without conducting the appropriate tests and totally qualifying the modification. This would obviously be quite expensive. Our concern then, that if your modification is not successful and causes an incident or accident, this would be attributed to our design, the Defiant. Because of this, we must insist that if you modify this aircraft with any major change (such as aerodynamic change, primary structural change,a non-approved engine or substituting materials), you call your aircraft a different name, rather than a Defiant. If you make a major change, you must consider yourself involved in basic aircraft design and development, an extremely risky business. As such it is not fair to us to be associated with any results of your development. We state this not to discourage inventivness and progress, but to release any connection of your development efforts with our proven design.

Remember, the accident you may have is not just another statistic, it is a homebuilt accident, the results of which can have an effect on the overall regulations governing the building and flying of amateur-built aircraft. The U.S.A. has the most lenient regulations for homebuilts of any country in the world and we can keep those regulations if we, through caution, common sense and self-policing retain our excellent safety record.

FAA LICENSING PROCEDURES

This procedure applies in the U.S.A. only. The FAA has a definite procedure for registering and licensing homebuilt aircraft. There is nothing complicated about it but they insist that you follow each step carefully.

1. Contact your local FAA engineering and manufacturing district office. Tell them you are building a Defiant homebuilt. Give the following information:
   3-view (copy from plans)
   Aircraft serial number (obtain from RAF)
   Aircraft registration # (if available)
   Approximate date of completion.
   Engine type.

FAA will then answer you and give you an idea of how much notice they will need for them to inspect your airplane and tell you where the approved test areas are etc.

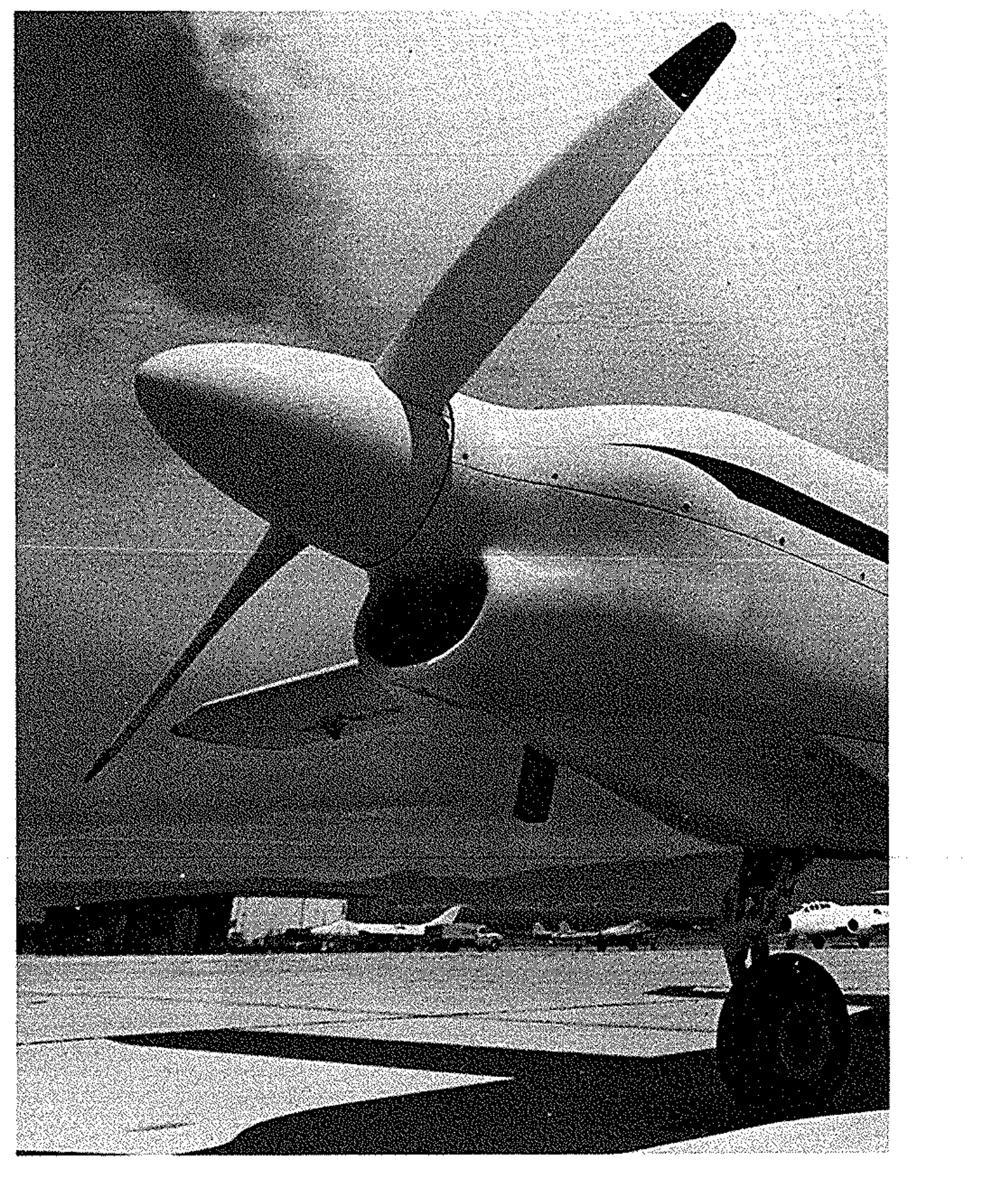
If you want to reserve a specific registration number (the number you will paint on the tail), you can ask for all numbers, or numbers followed by two letters. They are preceded by the letter "N". (For example N79RA, N81RA etc.). Be sure to give them your second and third choice, in case the number you want is already taken. Send $10 to reserve your special number. Address: FAA Aircraft Registry, BOX 25082, Oklahoma City, OK 73125.

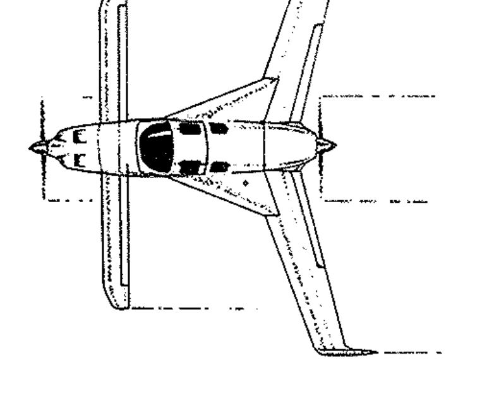
Do not register your aircraft until you are close to flying, no need to pay registration fees and property taxes yet.

When you are ready for inspection contact your local FAA office. Be sure you have an airframe log book (available from Spruce and Wicks) so that FAA can make an inspection entry.

To prepare for your final inspection, be sure you have the "N" number painted. It must be at least 3" high and in block letters with contrasting colors, the "Experimental" sign (2" high letters) on the canopy frame, the ID plate and passenger warning plate mounted (available from Spruce and Wicks). Before final inspection, fill out an application for registration (FAA form AC8050-1), a notarized affidavit that you built the airplane from parts that you bought yourself and include a $5 registration fee. Send those three things to the FAA Registry, Box 25082, Oklahoma, OK, 73125.

After you have made a final inspection of your aircraft, run the engine, conducted low speed taxi tests, etc. (See Owner's Manual). Contact your local FAA office and tell them you are ready to fly. They will, have you fill out an application of airworthiness, (form #8130-6), inspect your airplane and issue you an airworthiness certificate and a list of operating limitations that will restrict you to an unpopulated area for your initial test period. When you have completed your initial test period, contact FAA to get your operating limitations amended so you can fly outside your test area.





BILL OF MATERIALS

This chapter is a listing of the materials and components which are required to build a Defiant. The parts are categorized by type for your convenience when ordering.

RAF maintains a close liaison with the distributors listed, to assure proper materials specification and quality control. The distributors listed here are the only approved sources for materials. Do not make substitutions for the structural materials shown. The indicated materials were selected, developed, tested and optimized for ease of construction and structural integrity. RAF cannot provide assistance in the application of substitute materials. Each authorized distributor has a catalog or descriptive price list of the materials and components that they provide. The catalogs often cover a range of items beyond the basic requirements shown in the Bill of Materials and serve as a very handy reference. Those distributors who charge for their catalogs will refund the catalog charge with your first order.

The Defiant raw materials are available from either of the following distributors.

Aircraft Spruce and Speciality	Wicks Aircraft Supply
P.O.Box 424,	410 Pine Street
Fullerton, CA 92632	Highland, IL 62249
(714)870-7551	(618)654-7447
Catalog - $4.00	Catalog - $4.00

The Defiant gear is available from:

Task Research,
848 E. Santa Maria
Santa Paula, CA 93060
(805)525-4545

The Defiant Canopy is available from:

The Airplane Factory
7111 Brandt Vista,
Dayton, OH 45424
(513)845-9872

AIRFRAME

EPOXY	5 MINUTE EPOXY	2 EACH 1 QUART KIT.
	EPOXY	33.75 GALLONS. (27 KITS OF SAFE-T-POXY)

URETHANE FOAM- 2 lb/ft^3 - (GREEN OR TAN)
4 pcs 1"x24"x48"
5 pcs 2"x24"x48"

STYROFOAM BLOCKS - 2 lb/ft^3 (LIGHT BLUE ONLY)
6 pcs. 10"x24"x96"

POLY-VINYL - 3 lb/ft^3 - PVC CORE TYPE H45 (TAN)
1 pc 1"x32"x48"
17 pcs .625"x32"x48"
14 pcs .375"x32"x48"
9 pcs .250"x32"x48"

POLY-VINYL - 6 lb/ft^3 - PVC CORE TYPE H100 (TAN)
1 pc 1"x10"12"

FIBERGLASS

300 YARDS - UND CLOTH .009" x 38" (7715)
200 YARDS - BID cloth .013" x 38" (7725)
4 SPOOLS* - 'S' GLASS STRAND - (15 LBS EACH, 60 LBS TOTAL) *MINIMUM.

FILLER MATERIAL

3 LBS - FLOCKED COTTON
10 GALLONS - 3M B23 500 GLASS BALLOONS (MICRO SLURRY)

WOOD

2 PCS .7" x 1.5"x 144" LONG - SPRUCE.
3 PCS .25" x 48" x 48" 5 PLY BIRCH PLYWOOD.
1 PC .125" x 24" x 48" 3 PLY BIRCH PLYWOOD.

ALUMINUM EXTRUSIONS

1 PC. 36" LONG 2024-T3 90° ANGLE 1" x 1" x .125" THICK.
1 PC. 18" LONG 2024-T3 90° ANGLE 1.5" x 1.5" x .125" THICK.

1 PC. 5" LONG 2024-T3 RECTANGULAR BAR .1875" x 2".
1 PC. 1" LONG 2024-T3 RECTANGULAR BAR .375 x 2".

NYLON SHEET

1 PC. .125" x 2.5" x 4.5"
1 PC. .250" x 4.5" x 10"

SHEET METAL - STEEL

1 PC. 6" x 6" 4130 STEEL .025" THICK
1 PC. 6" x 6" 4130 STEEL .050" THICK
1 PC. 9" x 18" 4130 STEEL .063" THICK
1 PC. 6" x 12" 4130 STEEL .095" THICK
1 PC. 9" x 9" 4130 STEEL .125" THICK

STAINLESS STEEL TYPE 301 OR 302

1 PC 36" X 60" .016

ALUMINUM

1 PC. 12" x 12" 2024-T3 ALUMINUM .016" THICK
1 PC. 12" x 40" 2024-T3 ALUMINUM .020" THICK
1 PC. 12" x 24" 2024-T3 ALUMINUM .032" THICK
1 PC. 6" x 12" 2024-T3 ALUMINUM .050" THICK
1 PC. 12" x 24" 2024-T3 ALUMINUM .063" THICK
1 PC. 18" x 48" 2024-T3 ALUMINUM .125" THICK
1 PC. 6" x 6" 2024-T3 ALUMINUM .500" THICK

METAL TUBING AND ROD

2 PC	90" LONG	2024-T3 ALUMINUM 2" O.D. x .049"W
1 PC	12" LONG	2024-T3 ALUMINUM 1.875" O.D. X .063"W
2 PC	48" LONG	2024-T3 ALUMINUM 1" O.D. X .049"W
1 PC	24" LONG	2024-T3 ALUMINUM .750" O.D. X .049"W
1 PC	40" LONG	2024-T3 ALUMINUM .625" O.D. X .035"W
1 PC	60" LONG	2024-T3 ALUMINUM .500" O.D. x .035"W
1 PC	4" LONG	2024-T3 ALUMINUM .375" O.D. x .049"W
1 PC	3" LONG	6061-T6 ALUMINUM 1.125" O.D. x .058"W
1 PC	25 FEET	1200-0 ALUMINUM .25" O.D. x .032"W
1 PC	50 FEET	3003-0 ALUMINUM .375" O.D. x .035"W
1 PC	18"	3003-0 ALUMINUM 1/2" O.D. x .035"W
1 PC	48" LONG	2024-T3 ALUMINUM .500" DIAMETER ROD
1 PC	30" LONG	2024-T3 ALUMINUM .875" DIAMETER ROD
1 PC	4" LONG	2024-T3 ALUMINUM .625" DIAMETER ROD
1 PC	2" LONG	2024-T3 ALUMINUM 2.0" DIAMETER ROD
1 PC	12" LONG	STEEL PIANO WIRE (HARD) .09375" DIAMETER
1 PC	8" LONG	4130 N STEEL .625" DIAMETER ROD
1 PC	1" LONG	4130 N STEEL .500" DIAMETER ROD
6 PC	36" LONG	COLD ROLLED STEEL .375" DIAMETER ROD (commercial grade - used as weight only)
1 PC	24" LONG	4130 N STEEL 1" x 1" X .065"W SQUARE TUBE
1 PC	40" LONG	4130 N Steel 1.25" O.D. x .035"W
1 PC	43" LONG	4130 N STEEL 1.25" O.D. X .035"W
1 PC	24" LONG	4130 N STEEL 1.125 "O.D. x .065"W
1 PC	14" LONG	4130 N STEEL 1" O.D. x .065"W
1 PC	12" LONG	4130 N STEEL 1" O.D. x .049"W
1 PC	4" LONG	4130 N STEEL .875" O.D. x .065"W
1 PC	1" LONG	4130 N STEEL .875" O.D. x .058"W
1 PC	8" LONG	4130 N STEEL .750" O.D. x .095"W
1 PC	12" LONG	4130 N STEEL .750" O.D. x .065"W
1 PC	40" LONG	4130 N STEEL .750" O.D. x .049"W
1 PC	6" LONG	4130 N STEEL .625" O.D. x .095"W
1 PC	4" LONG	4130 N STEEL .625" O.D. x .065"W
1 PC	24" LONG	4130 N STEEL .500" O.D. x .065"W
1 PC	1" LONG	4130 N STEEL .500" O.D. x .058"W
1 PC	36" LONG	4130 N STEEL .500" O.D. x .049"W
1 PC	36" LONG	4130 N STEEL .500" O.D. x .035"W
1 PC	8" LONG	4130 N STEEL .375" O.D. x .083"W
1 PC	2" LONG	4130 N STEEL .375" O.D. x .065"W
1 PC	4" LONG	4130 N STEEL .375" O.D. x .058"W
1 PC	24" LONG	4130 N STEEL .375" O.D. x .035"W
1 PC	12" LONG	4130 N STEEL .375" O.D. x .028"W
1 PC	1" LONG	4130 N STEEL .3125" O.D. x .058"W
1 PC	24" LONG	4130 N STEEL .3125" O.D. x .028"W
1 PC	18" LONG	4130 N STEEL .250" O.D. x .028"W
2 PCS	9.3" LONG	4130 STEEL "MACHINED" .994± .001" O.D. X .122" WALL HEAT TREATED 150 KSI.
1 PC.	24" LONG	4130 N STEEL .571" MINOR X 1.349" MAJOR STREAMLINE TUBE.

BOLTS - (NO BOLTS ARE LISTED FOR L.G. AXLES - CUSTOM ORDER REQUIRED SIZES FOR YOUR AIRCRAFT)

3/16" BOLTS	
AN3-3A	(1)
AN3-4A	(2)
AN3-5A	(17)
AN3-6A	(12)
AN3-7A	(7)
AN3-10A	(1)
AN3-11A	(8)
AN3-12A	(2)
AN3-13A	(5)
AN3-14A	(5)
AN3-21A	(4)
AN3-31A	(1)

1/4" BOLTS	
AN4-6A	(8)
AN4-7A	(10)
AN4-10A	(4)
AN4-11A	(10)
AN4-12A	(2)
AN4-13	(1)
AN4-13A	(4)
AN4-14A	(1)
AN4-15A	(3)
AN4-16A	(2)
AN4-21A	(8)
AN4-22A	(2)
AN4-23A	(6)
AN4-26A	(3)
AN4-32A	(1)
AN4-33A	(1)
AN4-36A	(1)
AN4-40A	(2)
AN4-H10A	(2)

5/16" BOLTS	
AN5-10A	(1)
AN5-20A	(1)

3/8" BOLTS	
AN6-16A	(16)
AN6-21	(2)
AN6-35A	(1)
AN6-20A	(1)

1/2" BOLTS	
AN8-16A	(2)
AN8-33A	(2)
AN8-36A	(4)

MACHINE SCREWS

C/S SCREWS	
AN509-10R8	(12)
AN509-10R9	(4)
AN509-10R12	(6)
AN509-10R20	(4)
AN509-416R13	(8)
AN509-416R23	(8)
AN509-416R24	(24)
AN509-416R26	(8)
AN509-416R28	(20)
AN507-632R6	(10)

BUTTON HEAD SCREWS	
AN525-10R6	(1)
AN525-10R8	(37)
AN525-10R12	(3)
AN525-10R14	(3)
AN525-10R10	(10)
AN525-416R10	(8)
AN525-416R14	(4)
AN525-416R20	(1)
AN526-832-8	(3)

NUTS	
MS21042-3	(94)
MS21042-4	(152)
AN310-4	(1)
AN310-5	(2)
AN310-6	(2)
AN316-3R	(8)
AN316-4R	(15)
AN316-5R	(6)
AN316-6R	(1)
AN364-524	(2)
AN365-820A	(8)

WASHERS	
AN960-10	(100)
AN960-10L	(100)
AN960-416	(200)
AN960-416L	(100)
AN960-816	(25)
AN960-616	(25)
AN970-3	(25)
AN970-4	(25)

NUT PLATES	
K1000-3	(24)
K1000-4	(2)
K1000-08	(3)
K1000-06	(10)

COTTER PINS	
AN380-2-2	(5)
AN380-2-3	(10)

RIVETS - (Pop Type)	
AVEX 1601-0410	(50)
AVEX 1604-0412	(100)
MSP-43	200
MSC-43	100

RIVETS - (Solid Aluminum)	
AN426AD3-4	(25)
AN426A3-4	(25)
AN426A3-5	(15)
AN426A3-8	(20)
AN470A3-4	(10)
AN470AD3-8	(25)
AN470AD4-6	(15)
AN470AD4-7	(10)
AN470AD4-8	(15)
AN470AD4-10	(50)
AN470AD4-12	(10)
AN470AD5-6	(10)

CABLE AND CABLE HARDWARE

1 PC	12" LONG 1/16" 7 X 7 STAINLESS CABLE
1 PC	50 FEET 3/32" 7 X 19 STAINLESS CABLE
4	AN111-3 CABLE BUSHING
12	AN100-4 CABLE THIMBLE
2	AN100-3 CABLE THIMBLE
2	18-1-C SLEEVE
16	18-2-G SLEEVE
4	AN150-165 TURN BUCKLE

MISCELLANEOUS

7	AN394-11 CLEVIS PIN
1	AN393-23 CLEVIS PIN
3	A900 120" LONG 10-32 EACH END PUSH PULL CABLE
3	A900-3 55" LONG 10-32 EACH END PUSH PULL CABLE
2	HM-3 RODEND
12	HM-4 RODEND
3	HM-5 RODEND
2	HM-6 RODEND
4	HF-4 RODEND
2	HF-6 RODEND
2	F45-9 RODEND
1	AN486-2P CLEVIS FORK
1	AN481-4P CLEVIS FORK
1	AN481-2P CLEVIS FORK
3	AN490 HT8P THREADED ROD END
4	AN490 HT10P THREADED ROD END
2	AN490 HT16P THREADED ROD END
1	AN931-7-11 RUBBER GROMMET

PLUMBING AND CONDUITS

1 PC 24" LONG	1/2" O.D. X 3/8" I.D. POLYURETHANE TUBE
12	#6504 7/32" TO 5/8" CLAMP
20 FEET	#0500-071 VINYL TUBE
2	#108-HD 1/4" FUEL VALVE
12	AN819-6D SLEEVE
12	AN818-6D NUT
3	AN816-6D NIPPLE
2	AN825-6D TEE
3	AN822-6D ELBOW
2	CAV-110 SAF-AIR DRAIN
75 FEET	NYLAFLOW TUBE 3/16" OD X .025"W (CONDUIT AND BRAKE LINE)

WHEELS AND BRAKES

1	MOONEY NOSE GEAR WITH WHEEL (SEE D-39)
1 SET	CLEVELAND (600 X 6) #199-60 WHEEL & BRAKE
2	CESSNA MASTER BRAKE CLYINDER #9882010-801

CANOPY - AIRPLANE FACTORY

1	CANOPY
4 PCS	1/8" X 14" X 18"

6	BC-4-W10 BELLCRANK BEARING
2	KP-4 1/4" I.D. X .901 O.D. BEARING
1	NYLON HORN (RUDDER TRIM) MODEL AIRPLANE
11	DU-BRO NYLON HINGE MODEL AIRPLANE
1	KPS-1511 TRIM SERVO
2	CESSNA PEDAL #1460320-1
1	PIPER PITOT-STATIC - NON HEATED #65797-03 - HEATED #69041-03
10 FT	#970F FIBERFRAX PAPER INSULATION 24" WIDE
8	.250 I.D. X .375" O.D. X .2" LONG WITH SHOULDER OILITE BUSHING (PRESSED INTO CS-2 - SEE D-24)
2	.250" I.D. X .374" ± .001 O.D. X 1.0" LONG OILITE BUSHING
2	3" UNVENTED FUEL CAP AND FLAT ASSEMBLY #416-51AB
12 FT	.500" COPPER FOIL TAPE (ANTENNA) (HOBBY CRAFT STAIN FOIL)
60 FT	RG58-AU ANTENNA COAX
9	FERRITE BEADS FOR RG58-AU COAX
8.5 LBS.	LEAD FOR CS-6 (SEE D-24)
3.0 LBS.	LEAD SHOT FOR RUDDER (SEE D-57)

1 PC	52"	MS2001P5 HINGE
1 PC	24"	MS2001P6 HINGE
1 PC	72"	MS20257-3 HINGE
1 PC	42"	MS20257-4 HINGE

PART LIST CROSS REFERENCE

ELEVATOR AND CANARD

PART #	QTY	PAGE	
CS-1	2	D-24	2" X .049" 2024-T3 OR 6061-T6 ALUMINUM ELEVATOR TUBE 90"LONG
CS-2	8	D-24	.050" 4130 STEEL ELEVATOR HINGES
CS-3	8	D-24	.125" 2024-T3 ALUMINUM ELEVATOR HINGE
CS-4	2	D-25	2024-T3 ALUMINUM MACHINED ELEVATOR TUBE PLUG
CS-5	8	D-24	6061-T6 OR 2024-T3 ALUMINUM ELEVATOR TUBE REINFORCEMENT
CS-6	2	D-24	SOLID LEAD ELEVATOR COUNTER BALANCE
CS-7	2	D-26	2024-T3 5/8" O.D. X 3/8" I.D. X .9" LONG SPACER
CS-8	8	D-26	.063" 2024-T3 ALUMINUM CANARD ATTACH PLATE
CS-9	2	D-25	.032" 2024-T3 ALUMINUM FORWARD CANARD TABS
CS-10	2	D-25	.063" 2024-T3 ALUMINUM FORWARD CANARD TABS WITH ANCHOR
CS-11	4	D-25	BUSHING 2024-T3 FOR CANARD TABS, AFT

CONTROL SYSTEM

PART #	QTY	PAGE	
C-1	1	D-48	4130 STEEL - RIGHT CONTROL STICK
C-2	1	D-48	4130 STEEL - LEFT CONTROL STICK
C-3	2	D-48	.374" O.D. .250" I.D. 1.0" LONG OILITE BUSHING
C-4	2	D-48	.063" 2024-T3 ALUMINUM BRACKET
C-5	2	D-48	.063" 2024-T3 ALUMINUM MOUNT COVER
C-6	2	D-48	.063" 2024-T3 ALUMINUM BRACKET
C-7	2	D-48	.125" BELLCRANK 2024-T3
C-8	2	D-48	.125" 2024-T3 ALUMINUM - PART OF CONTROL LEVER C-9
C-9	2	D-48	.125" 2024-T3 ALUMINUM CONTROL LEVER - PART OF C-8
C-10	2 PR	D-48	.125" 2024-T3 EXTRUDED ANGLE (PAIR)
C-11	1	D-48	.125" 2024-T3 EXTRUDED ANGLE SIDE LOAD BRACE (LEFT)
C-12	1	D-48	.125" 2024-T3 EXTRUDED ANGLE SIDE LOAD BRACE (RIGHT)
C-13	2	D-48	HARD WOOD SIDE LOAD STOP FOR C-11 AND C-12
C-14	4	D-48	.25" I.D. X .5" X O.D. X 1.15" LONG 2024-T3 ALUMINUM
C-15	6	D-48	.25" I.D. X .5" X O.D. X .65" LONG 2024-T3 ALUMINUM
C-16	2	D-48	.25" I.D. X .5" X O.D. X .525" LONG 2024-T3 ALUMINUM
C-17	8	D-48	.063" 2024-T3 ALUMINUM CABLE FORK LINK
C-18	1	D-48	.125" 2024-T3 ALUMINUM SUPPORT BRACKET FOR C-20 (RIGHT SIDE)

PART #	QTY	PAGE	
C-20	1	D-48	(A) & (B) .065" 4130 ENDS 1 1/4" X .035" STEEL TUBE ELEVATOR ACTUATOR (COMPLETE UNIT)
C-21	2	D-48	.500" X .035" 2024-T3 ALUMINUM ELEVATOR CONNECT ROD
C-22	1	D-48	.125" 2024-T3 ALUMINUM ELEVATOR (ROLL TRIM) ARM FOR C-20
C-23	1	D-48	.063" 2024-T3 ALUMINUM ROLL TRIM MOUNT
C-24	1	D-48	.75" X 2" WOOD TRIM KNOB
C25	1	D-26	1/2" X .035" 2024-T3 ALUMINUM TRIM TUBE WITH AN-490-HT6P
C-26	2	D-48	ELEVATOR PUSH ROD 1/2" X .035" 4130 PLUS ROD ENDS HF-4 & HF-6
C-27	1	D-48	(A,B & C) AILERON ACTUATOR (REAR FIREWALL)
C-27A	1	D-48	AILERON ACTUATOR
C-27B	4	D-48	AILERON ACTUATOR
C-27C	1	D-48	AILERON ACTUATOR
C-27D	1	D-48	AILERON ACTUATOR
C-28	2	D-26	2024-T3 ALUMINUM SUPPORT FOR C-27
C-29	1	D-42/45	ENTRY STEP .571" MINOR X 1.349" MAJOR 4130
C-30	1	D-27	PLYWOOD INSERT (CANARD) FOR PITOT STATIC

THROTTLE QUADRANT

PART #	QTY	PAGE	
TQ-1	2	D-47	.125" THICK NYLON 2 1/4" DIAMETER DISC
TQ-2	1	D-47	.125" 2024-T3 ALUMINUM FORWARD MIXTURE
TQ-3	5	D-47	.250" THICK NYLON FRICTION PART
TQ-4	1	D-47	.125" 2024-T3 ALUMINUM REAR MIXTURE
TQ-5	2	D-47	.250" THICK NYLON 2 1/4" DIAMETER DISC
TQ-6	1	D-47	.125" 2024-T3 ALUMINUM FORWARD THROTTLE
TQ-7	1	D-47	.125" 2024-T3 ALUMINUM REAR THROTTLE
TQ-8	1	D-47	.125" 2024-T3 ALUMINUM FORWARD CARB
TQ-9	1	D-47	.125" 2024-T3 ALUMINUM REAR CARB

CANOPY LATCH

PART #	QTY	PAGE	
LOC-1	1	D-50	.125" 2024-T3 ALUMINUM CANOPY HINGE ANCHOR
LOC-2	2	D-51	.125" CANOPY LATCH 2024-T3
LOC-3	1	D-51	.050" 4130 STEEL LOCK LATCH WELDMEN
LOC-4	3	D-51	.025" 4130 STEEL PLATE GUIDE
LOC-5	2	D-51	.190" 2024-T3 ALUMINUM GUIDE
LOC-6	1	D-51	COMPLETE WELDED LOCK ASSEMBLY (CONSISTS OF LOC-6A & 6B)
LOC-6A	2	D-51	.050" 4130 STEEL ARM
LOC-6B	2	D-51	3/8" X .058" X 3" 4130 STEEL
LOC-7	2	D-51	COMPLETE WELDED LATCH ASSEMBLY (CONSISTS OF LOC-7A,7B,7C)
LOC-7A	4	D-51	.050" 4130 STEEL
LOC-7B	2	D-51	5/16" X .058" 4140 STEEL
LOC-7C	2	D-51	.190 2024-T3 ALUMINUM

LOC-8	1	D-51	.125" 4130 STEEL LOCK LINK (TAP 10-32 2 PLACES)
LOC-9	1	D-51	.125" 4130 STEEL LOCK LINK (2 ELONGATED 3/16 HOLES)
LOC-10	1	D-51	3/8" X .035" 2024-T3 ALUMINUM TUBE - 30" MAXIMUM
LOC-11	2	D-51	1/2" X 5/8" 2024-T3 ALUMINUM HANDLES
LOC-12	1	D-51	3/8" I.D. 2024-T3 BUSHING
LOC-13	1	D-51	.125" X 1.5" X 1.5" 2024-T3 ALUMINUM EXTRUDED ANGLE
LOC-14	1	D-51	.125" X 1.5" X 1.5" 2024-T3 ALUMINUM EXTRUDED ANGLE
LOC-15	2	D-51	2024-T3 ALUMINUM 1/2" ROUND STOCK

NOSE GEAR BOX

PART #	QTY	PAGE	
NGB-1	2	D-35	1/4" SOLID GLASS BID PADS (EARS)
NGB-2	2	D-35	1/8" SOLID GLASS BID PADS
NGB-3	1	D-35	1/4" PLYWOOD (SHORT)
NGB-4	1	D-35	1/4" PLYWOOD (LONG)
NGB-5	1	D-35	3" X 3" X 5/8" PLYWOOD INSERT
NGB-6	1	D-35	RIGHT SIDE UPPER BOX
NGB-7	1	D-35	LEFT SIDE UPPER BOX
NGB-8	1	D-35	PEDAL ADJUSTMENT ATTACH PLYWOOD INSERT
NGB-9	2	D-35	LEFT AND RIGHT SIDE OF LOWER BOX
NGB-10	1	D-35	1/4" R45 AFT END OF LOWER BOX
NGB-11	2	D-42	.065" 4130 STEEL GEAR ATTACH POINT (2.3" X 2.3")
NGB-12	2	D-42	.040" 4130 STEEL GEAR ATTACH POINT (2.3" X 2.3")
NGB-13	1	D-42	1/8" ALUMINUM REINFORCEMENT (EARS) BENT RIGHT
NGB-14	1	D-42	1/8" ALUMINUM REINFORCEMENT (EARS) BENT LEFT
NGB-15	1	D-42	.058 ALUMINUM REINFORCEMENT (EARS) BENT RIGHT
NGB-16	1	D-42	.058 ALUMINUM REINFORCEMENT (EARS) BENT LEFT
NGB-17	2	D-42	BUSHING 2024-T3 3/8" W X .75" O.D. X .375" ID
NGB-18	2	D-41	BUSHING 1015-1020 STEEL 3/4" O.D. X 5/8" I.D. X .8" LONG

BULKHEAD REINFORCEMENT LAYUPS

PART #	QTY	PAGE	
BRL-1	4	D-34	1.5" X 4" X APPROXIMATELY .75" WEDGE (SPRUCE)
BRL-2	4	D-34	1/4" PLYWOOD CENTERSECTION SPAR REINFORCEMENT - TOP
BRL-3	4	D-34	1/4" PLYWOOD CENTERSECTION SPAR REINFORCEMENT - BOTTOM

CONSOLES

PART #	QTY	PAGE	
CON-1	6	D-44	.8" X .8" PLYWOOD INSERTS
CON-2	2	D-45	SEAT BELT (FRONT) PLYWOOD REINFORCEMENT
CON-3			SEAT BELT (REAR) PLYWOOD REINFORCEMENT
CON-4	2	D-46	.125" X 1" X 1" X 2" 2024-T3 ALUM. EXTRUSION SEAT BELT ATTACH (FRONT)
CON-5	2	D-46	.125" X 1" X 1" 2024-T3 ALUMINUM EXTRUSION SEAT BELT ATTACH (REAR)

MAIN LANDING GEAR

PART #	QTY	PAGE	
MG-1	2	D-37	.1 1/8" X .065" X 7"L 4130 STEEL
MG-2	4	D-37	.095" 4130 PLATE DRILL .995 AND 1/4" CS SPACERS
MG-3	4	D-37	1/2" X 2.6" X 2.6" PLATE 3/8" NF THREAD, 4 PLACES AND DRILL 1.25" DIAMETER 2024-T3 ALUMINUM
MG-4	2	D-37	MACHINED .994" ±.001" X .125" WALL 4130 STEEL HEAT TREATED 150 KSI
MG-5	4	D-37	1/8" X 2.6" X 2.6" 2024-T3 ALUMINUM
MG-6	8	D-37	1 1/8" X .065" X .5" LONG 4130 STEEL
MG-7	2	D-37	.063" PLATE 2024-T3 ALUMINUM INSIDE G.L. PLATE
MG-8	2	D-37	.125" PLATE 2024-T3 ALUMINUM OUTSIDE GEAR LEG PLATE

NOSE GEAR

PART #	QTY	PAGE	
NG-1	1	D-41	1" X 1" .065" AND 3/4" X .049" RETRACT ARM (CONSISTS OF)
NG-1A	1	D-41	1" X 1" .065" 4130 STRUT
NG-1B	1	D-41	3/4" X .065" TUBE (ARM) 4130
NG-1C	1	D-41	.9" LONG 5/16" X .028" 4130
NG-1D	1	D-41	.9" LONG 1/4" X .028" 4130
NG-1E	1	D-41	1/2" X .049" X 4.85" 4130 RETRACT ARM
NG-1F	1	D-41	.125" 4130 STEEL REINFORCEMENT WELD TO 1" X 1" STRUT-LEFT
NG-1G	1	D-41	.125" 4130 STEEL REINFORCEMENT WELD TO 1" X 1" STRUT-RIGHT
NG-1H	2	D-41	.125" 4130 STEEL REINFORCEMENT (END) TO 1" X 1" STRUT
NG-2	1	D-41	RETRACT PIVOT (CONSISTS OF THE FOLLOWING)
NG-2A	2	D-41	PLUG TAPPED 3/8" NF THREAD 4130 STEEL
NG-2B	1	D-41	3/4" X .065" 4130 STEEL 5.9" LONG
NG-2C	2	D-41	3/4" X .065" 4130 STEEL 2.5" LONG
NG-2D	2	D-41	1/2" X .065" 4130 STEEL 2.25" LONG
NG-3	2	D-41	5/8" X .095" 4130 STEEL PIVOT INSERT INTO NG-2
NG-4	1	D-41	.125" X 1" X 1.5" 2024-T3 ALUMINUM EXTRUSION TRIP HANDLE
NG-5	1	D-41	1/4" X .028" x 12.4" LONG TIE ROD
NG-6	1	D-41	.040" 4130 STEEL LOCK LATCH
NG-7	1	D-41	.125" 2024-T3 LOCK LATCH
NG-8	1	D-41	.095" PLATE AND 7/8" X .065" TUBE 4130 STEEL STEERING ARM
NG-9	1	D-41	.125" 4130 STEEL FORK STEERING
NG-10	1	D-41	5/8" X .065" AND 1/2" X .065" LINKAGE ARM
NG-10A	1	D-41	3/8" X .065" REAM TO .250" I.D.
NG10B	1	D-41	4130 PLUG TAPPED 5/16" - 24 NF
NG-11	1	D-41	3/4" X .095" ARM (PETERSON FLOOR LEVEL) 4130 STEEL
NG-12	1	D-41	7/8" X .065" SLEEVE THROUGH FLOOR FOR NG-11 4130 STEEL
NG-12A	1	D-41	7/8" X .063 4130 STEEL 18" LONG
NG-12B	1	D-41	.040 4130 STEEL
NG-12C	1	C-41	.040 4130 STEEL

INSERTS

PART#	QTY	PAGE	
INS-1	12	D-42	.427" ±.001" 2024-T3 INSERTS FOR ROD
INS-2	1	D-42	AN970-3 DRILL TO .265" I.D. - 17/16" DRILL
INS-3	1	D-51	.303" X 1.3" 10-32 2024-T3

RUDDER

PART #	QTY	PAGE	
RUD-1	1	D-34	PLYWOOD WEDGE 3" X 3" X .250" TO 0"
RUD-2	1	D-42	.125" 2024-T3 FLOOR PLATE
RUD-3	1	D-42	RUDDER ASSEMBLY (CONSIST OF THE FOLLOWING)
RUD-3A	1	D-42	LOWER INSERT
RUD-3B	1	D-42	UPPER INSERT
RUD-3C	1	D-42	LOWER WELDED TUBE
RUD-3D	1	D-42	UPPER WELDED TUBE
RUD-3E	1	D-42	UPPER ARM
RUD-3F	1	D-42	LOWEST ARM
RUD-3G	1	D-42	MIDDLE ARM
RUD-3H	1	D-42	MAIN TUBE
RUD-4	1	D-42	ANGLE TO HOLD RUD-3
RUD-5	1	D-42	ONE PUSH ROD
RUD-6	1	D-42	ONE PUSH ROD
RUD-7	2	D-42	2024-T3 .080" TO FORM LEFT SIDE ANGLE TO HOLD RUD-9
RUD-8	1	D-42	RIGHT .125" 2024-T3 HOLDS RUD-9
RUD-9	1	D-42	1" X .049" 4130 STEEL HOLDING PEDALS
RUD-9A	1	D-42	.063" 4130 STEEL
RUD-9B	1	D-42	.063" 4130 STEEL
RUD-9C	1	D-42	.063" 4130 STEEL
RUD-10	1	D-42	LEFT PEDAL STRUT 3/4" X .049" 4130 STEEL
RUD-11	1	D-42	RIGHT PEDAL STRUT 3/4" X .049" 4130 STEEL
RUD-12	1	D-39	LEFT CESSNA PEDAL
RUD-13	1	D-42	RIGHT CESSNA PEDAL
RUD-14	2	D-42	.125" 2024-T3 PEDAL BRACKET
RUD-15	4	D-42	.125" BRACKET FOR MASTER CYLINDER
RUD-16	2	D-42	.375" (3/8") ROD 2024-T3 DRILL TO .250" X .2" LONG
RUD-17	2	D-42	.375" (3/8") ROD 2024-T3 DRILL TO .250" X .35" LONG
RUD-18	1	D-42	1/2" X .035" 4130 STEEL TIER ROD (STEERING)
RUD-19	1	D-42	ADJUSTMENT ROD - PEDALS 3/8" X .035" 4130 STEEL
RUD-20	1	D-42	ANCHOR FOR PEDAL ADJUSTMENT ROD - RUD-19
RUD-21	1	D-42	3/32" PIANO WIRE LOCK CLIP
RUD-22	4	D-42	5/16" X .028" 4130 STEEL SPACER AND BUSHING

AILERON

PART #	QTY	PAGE	
A-1	2	D-29	3/4" X .049" X 10" 2024-T3 ALUMINUM
A-2	2	D-32	.032" X 8.5" LONG 2024-T3 ALUMINUM
A-3	6	D-32	.032" X 6.5" LONG 2024-T3 ALUMINUM
A-4	2	D-32	8" LONG MS20001 P6 HINGE ALUMINUM
A-5	4	D-32	6" LONG MS20001 P6 HINGE ALUMINUM
A-6	2	D-32	6" LONG MS20001 P6 HINGE ALUMINUM
A-7 PCS	6	D-32	BALANCE WEIGHT (3/8" STEEL ROD)
A-8	2	D-32	TIE ROD 5/8" X .035" 2024-T3 ALUMINUM
CSW2	2	D-29	4130 MACHINED INSERTS INTO A-1

MAIN WING ATTACH POINTS

PART #	QTY	PAGE	
LEFT			
DWA-6	1	D-29	INBOARD PLYWOOD INSERT
DWA-7	1	D-29	OUTBOARD PLYWOOD INSERT
DWA-3	1	D-29	OUTBOARD WINGLET ATTACH
DWA-8	1	D-29	INBOARD CENTERSECTION SPAR
DWA-5	1	D-29	OUTBOARD CENTERSECTION SPAR
RIGHT			
DWA-1	1	D-2	INBOARD PLYWOOD INSERT
DWA-2	1	D-2	OUTBOARD PLYWOOD INSERT
DWA-3	1	D-2	OUTBOARD WINGLET ATTACH
DWA-4	1	D-2	INBOARD CENTERSECTION SPAR
DWA-5	1	D-2	OUTBOARD CENTERSECTION SPAR

PART #	QTY	PAGE	
WA-1	4	D-19	21± PLIES BID PAD 3.3" X 3.3"
WA-2	2	D-29	21± PLIES BID PAD 3.3" X 3.3"
WA-3	4	D-29	.125" X 3" X 3" 2024-T3 ALUMINUM CENTERSECTION HOLES.
WA-3A	4	D-29	.125" X 3" X 3" 2024-T3 ALUMINUM CENTERSECTION HOLES.
WA-4	4	D-29	.125" X 3" X 5.4" 2024-T3 ALUMINUM CENTERSECTION HOLES.
WA-4A	2	D-29	.125" X 3" X 5.4" 2024-T3 ALUMINUM CENTERSECTION HOLES.
WA-4B	2	D-29	.125" X 3" X 5.4" 2024-T3 ALUMINUM CENTERSECTION HOLES.
WA-5	2	D-19	21 ± PLIES BID PAD 3.3" X 5"
WA-6	12	D-30	2024-T3 ALUMINUM
CR-1	2	D11	21± PLIES BID CANARD ATTACH POINT
MGA-1	2	D-15	21± PLIES BID BULKHEAD 144.5
MGA-2	2	D-16	21± PLIES BID BULKHEAD 153
A	1	D-29	PATTERN DRILLING JIG
B	1	D-29	PATTERN DRILLING JIG

RECOMMENDED ORDER OF CONSTRUCTION

The following is the only recommended order of building a Defiant. This is the method used by Fred Keller while building the homebuilt prototype. The photographic segment, (Segment C) has been arranged in the proper sequence of construction with the exception of the attachment of the winglets to the wings. Due to storage problems (and a probable lack of 10 foot high ceilings) we recommend that you postpone the winglet to wing attachment until the final assembly of the aircraft. Segment D contains all of the drawings and illustrations and these have also been arranged as closely as possible to agree with Segment C and this recommended order of building. The illustrations and captions on each D page are not necessarily in any order, and you the builder must correlate the information required as your project progresses. The careful use of several D pages to gain the necessary data will sometimes be required.

Before you begin construction on your Defiant, it is an good idea to get your workshop ready for the project. A good place to start is the work tables that will be required.

Refer to Page D-1 and to the Education Section on Page B-1. These are the work tables that Fred designed and built due to the relatively small amount of shop space he had to build his Defiant. He built two tables 24" wide by 48" long, and two more tables 24" wide by 96" long. He designed them so that they would "nest" together to make two 12 foot tables or one 24 foot table. This gave him the maximum use of the space available. These tables should be about 37" high, but build them to suit yourself. They should be relatively straight and flat, but do not have to be absolutely perfect since all parts to be jigged on these tables, will be shimmed to level and straight, and then glued to the table with Bondo.

If you are tight on building space, Fred's nesting work tables are a great idea. Refer to page B-4 for a sketch of an excellent space saver cutting table. You can store your rolls of glass in a clean, warm, dry environment, and fold the door down to form a cutting table. This cutting table can be marked with 30°, 45° and 90° lines every 6" with a magic marker, which greatly facilitates cutting the cloth.

An excellent idea while you are waiting for your composite materials to arrive, or any time you have time on your hands waiting for a major part to cure for example, is pull out Pages D24, D41, D42, D47, D48 and D51 and make the metal parts. Having all of the metal pieces including weldments, assemblies such as canopy latches, throttle quadrants etc, sitting on the shelf ready to install, can make the progress of your project more efficient and rapid. Any zinc chromate painting or cad plating or even anodizing you may wish to do, should be done before you install any of these metal parts into the airplane permanently.

1. TEMPLATES AND JIGS

A. Make all of the hotwire templates. These will be found on Page D-1 through D-4. Formica is an excellent material for hotwire templates. 1/8" aircraft birch plywood, or 1/32" aluminum also do a good job.

B. Make all of the jigs, fixtures and checking templates. These are on Pages D-5, D-6, D-7, D-23 and D-28. The best material for jigs and fixtures is 1/2" plywood. The cheapest interior grade is fine.

1. FUSELAGE BULKHEADS

A. Refer to Page D-8 for the bulkhead layout. This is the reference drawing that will be helpful in knowing where each bulkhead will be positioned.

B. Build all of the bulkheads starting with the forward firewall (F.S.47). Refer to Page C-1 for photographs of some of the bulkheads under construction. Full size templates of all the bulkheads are on Pages D-9 through D-17. There are many useful notes all through these drawings, read them all carefully and be sure you understand before proceeding.

While you are building the fuselage bulkhead, you will notice that there are several solid glass hardpoint inserts that are required. These parts are shown on Pages D11, D15, D16, D19 and D29. The easiest and most convenient way to make these inserts is to layup a single laminate roughly 18" x 20" out of BID glass cloth with 21 plies. (Yes, 21 plies!). The orientation of each ply is not critical. You can prepare a surface to do the layup on by taping a piece of Saran Wrap or plastic over a smoother surface, such as a piece of particle board, or you can polish up a flat sheet of steel or aluminum and wax the surface. The purpose is to end up with a solid glass (BID) laminate that is nice and flat and that is approximately 1/4" thick. You can then outline each of the 14 solid glass inserts required in the Defiant and saw them out using a band saw or a saber saw with a carbide blade. You will get better results if you tape a sheet of peel ply (Dacron) over the area before doing the layup, then wet out a sheet of Dacron over the top of the last ply (21 plies). A flat smooth piece of particle board with plastic Saran Wrap taped over it can be laid on top of this laminate and weighted down to give a nice uniform dense layup. After sawing out the parts, the peel ply can be removed and the inserts epoxied into place with a minimum of preparation.

4. CENTERSECTION SPAR

A. Build the centersection spar jigging tool. Page D-18 is an accurate 1/5 scale drawing of the parts to build the jig, the method of building the jig and of the finished jig itself. See Page C-1 for photos of Fred's jig under construction. The jig is built entirely of 1/2" particle board and can be assembled using Elmers glue or even Thermogrip hot melt glue.

B. Page D-19 contains accurate 1/5 scale drawings of the centersection spar. Page D-30 has more information on the local "hard points". There are accurate full scale sections, as well as full scale details on the "hard point" wing attach areas. Refer to Page C-1 for photographic details. The spar caps on your centersection spar are made up of multiple strands of 'S' glass roving. These strands should be pulled through your "roving wetting machine" and laid into the spar "troughs". Note that the longest strands go into the "troughs" first, and the shortest go in last. It is good practice when cutting the roving strands to cut them at an angle rather than straight across. This makes for a better tapered spar.

5. HOTWIRE FOAM CUTTING

Page D-20 contains all of the information you will need to hotwire cut all of the foam cores for your Defiant. Spend enough time with this page to thoroughly acquaint yourself with what you will be doing. There is a lot of information in the form of drawings, sketches and words. There are suggestions on how to set up to cut the necessary angles through the foam. Fred has given the various foam blocks a "color" code. This "color", for example the "RED" block, will be used to hotwire cut four wing cores. The cores have the part numbers FC-6, FC-13, FC-11 and FC-17. You can keep track of your foam by literally color coding each block as shown using latex paint dabs. Do not paint the actual hot wired foam cores, only the outside of the uncut block.

Here at RAF, we have found that it will minimize foam core warpage if you cut out only the pieces you will be using immediately. Some people advocate cutting all the cores out at one time. If you elect to go this route, be sure and tape the blocks and cores back together. Carefully protect the cores and cover them with black plastic and weight them down to keep them straight. Sunlight will damage the surface of the styrofoam, so they must be protected from direct sunlight and even indirect light if the cores won't be used for an extended period of time. Refer to Pages C-2 and C-3 for many detailed photos of foam core hotwire cutting.

6. WINGLETS

The first hotwire cut parts we recommend you build are the winglets. Page D-21 has detailed information concerning assembling the foam cores, the shear webs, spar caps etc. This page also contains information you will need much later on regarding the installation of the winglets onto the main wings. Disregard this for the moment and build your winglets. Do not forget to install the comm antennas. We would strongly recommend installing one comm antenna on each winglet at least for redundancy and especially if you intend to install dual comm radios. Note that this type of antenna is installed onto the foam core before the glass skins are layed up. The coax cable should be buried beneath the surface, and even the copper foil tape can be sunk slightly into the foam in order to have the smoothest contour after the glass skins are installed. Page D-22 contains information which will be required much later, when you install the winglets to the wings. Unless you are building your Defiant in a large warehouse or have unlimited storage, we recommend that you do not install the winglets to the wings until just prior to taking the airplane to the airport for final assembly. See photo Page C-3 for details.

7. CANARD

Page D-23 shows in detail the method used for jigging, the shear web layup, the spar caps ('S' glass roving) and the bottom wing skin. Refer to D-20 for foam core layout. Page D-24 shows the top skin, the elevators and the elevator hinges. Do not forget to install the elevator hinge mounting hard points (6 lb/ft^3 PVC foam blocks) after you layup the bottom skin but before you layup the top skin. Refer to Page D-25 for a canard plan view and details of the canard attach points (lift tabs) and associated hardware. Page D-26 shows canard attachment to fuselage details as well as elevator actuation, pitch control and pitch trim details. Page D-27 shows canard to elevator hinge details, pitot static details and navigation antenna details. Most important, this page contains a detailed layup schedule for the entire canard. Each glass layup is called out and numbered, and these numbers can be found throughout the canard section. See photo Pages C-2, C-4 and C-5.

8. WINGS

Page D-28 shows the layup schedule for the main wings. A 1/5 scale plan view of the right wing is most useful and shows fuselage stations (F.S.) and butt lines (B.L.) as well as sweep angles, glass ply orientation, aileron layout and hinge positions etc. The wing jigs are shown and an isometric drawing gives details of the wing jigging procedure. Page D-29 shows full scale details of the wing attach hard points. Page D-30 shows accurate full scale details of the wing attach points as well as a layout to show where the various hardpoints are located and their associated part numbers. Page D-31 shows good detail of wing foam core layout, shearweb, spar caps, and wing skin orientation. Aileron details are shown on this page and on D-32. Pay particular attention to the three full scale sections through the ailerons, to be sure you get the hinge pivot in the correct position relative to the leading and trailing edges of the aileron. This will assure that the aileron will balance correctly. Refer to Pages C-5, C-6 and C-7 for excellent photographic detail of Fred's wings.

9. FUSELAGE

Jigging Bulkheads - Refer to Page D-8 for fuselage top view and side view. Page D-33 is the reference drawing for bulkhead layout. A 1/5 scale layout shows the bulkheads which will be jigged upside down on a fixture (stiff-back). Refer to photo Pages C-1 and C-8 for details. Page D-34 shows details of glass skin orientation, number of plies, and method of attaching sides and bottom of bulkheads. You should use the order of photos on the C pages as a guide throughout this section.

10. NOSE GEAR BOX

Pages D-35 and D-36 has information relating to the nose gear box. Refer to photo Pages C-8 and C-9 for more details.

11. MAIN GEAR

Main gear preparation and installation is covered on photo Pages C-9 and C-10 and on Page D-37.

12. FUEL SUMP TANKS

Fuselage sump fuel tanks and fuel valve details are shown on Page D-38. Refer to photo Page C-10. Note that the PVC foam parts of the sump tanks are glued together (prior to slurrying) with Thermogrip hot melt glue.

13. NOSE GEAR RETRACT MECHANISM AND RUDDER/BRAKE PEDAL ASSEMBLY

Page D-39 and D-40 are full scale side view and plan view of the nose gear retract mechanism, nosewheel steering mechanism and the rudder/brake pedal assembly. Page D-41 and D-42 show full scale parts required to build the nose gear retract mechanism and rudder/brake assembly.

14. COCKPIT CONSOLES

Cockpit consoles, center and side panels are shown on Pages D-43, D-44 and D-45. Head rests, seats and seat supports are also shown here. The entry step, a steel weldment is shown on D-45.

15. SEAT BELT ATTACH

Seat Belt attach method and accurate sections including local reinforcement layup schedules are shown on page D-46. Also on this page is the aft seat/folding bed.

16. THROTTLE QUADRANT

Page D-47 contains full scale drawings of the throttle, carb heat and mixture quadrant. This is exactly what Fred used in his Defiant and it works extremely well. Fred carved all the wood parts from walnut and painted them with epoxy to seal and preserve them. He also polished the aluminum parts that are visible in the cockpit. See photo Pages C-10 and C-11.

17. CONTROL SYSTEM

Page D-48 shows the control sticks, associated belcranks, brackets, pushrods and weldments. These are shown full size unless noted "no scale". The elevator torque tube is also detailed on this page. See photos on Page C-11.

Refer to Pages D-41 and D-42 for rudder pedal and yaw control system details. The lateral control system is shown on Pages D-26, D-32 and D-48. Note that roll control is transmitted from the control stick assemblies (left and right) to aft of the aft firewall to Part # C-27 via 3/32" aircraft cable. To facilitate stick position adjustment as well as cable tension, it may be desirable to install turnbuckles in these cables.

18. CANOPY FRAME AND TURTLE DECK

Pages D-49, D-50 and D-51 contains information pertaining to building the canopy frame, the aft turtle deck, and the canopy latches. Pages D-49 and D-50 show the method of jigging the canopy frame and turtle deck, as well as layup schedules and plexiglass installation. Also on D-50 is the method to fit the canard to the forward fuselage. This must be done carefully and accurately. The canopy latch mechanism is shown in full size detailed drawings on Page D-51. See C-11 and C-12 for photos.

19. MAIN WING ATTACH

Main wing attach method is shown on Page D-52. This must be done before the fuel strake/tanks are installed. Refer also to Page D-30 for accurate detailed sections of the wing attach points. See Page C-13 for photos.

20. FUEL STRAKES

Pages D-53, D-54, D-55 and D-56 contain the information necessary to build the main fuel tanks or strakes. Refer to Pages C-13 and C-14 for photos of this procedure.

Full size fuel tank rib (baffle) templates are on Pages D-53 and D-54. A 1/5 scale drawing showing an accurate layout of the fuel tank on the side of the fuselage is also on page D-54. The method used to jig and build the fuel tanks, including number of plies and orientation of each ply, details on fuel line pick up points, fuel cap installation etc. can be found on Pages D-55 and D-56.

21. RUDDER

Page D-57, the last page in this section, contains the information necessary to build the rudder, including the electric rudder trim. Refer to Page D-1 for the hot wire templates for the rudder.

That concludes the recommended "order of building your Defiant". Remember to cross reference from the drawings to the photos. Carefully read the captions under the photos. Carefully read and be sure you understand all of the notes written among the drawings and sketches. Check the material list for information, part numbers, material call out, dimensions etc. All of the information to build the airframe is in these plans. Occasionally you may have to dig for it by cross referencing. Time spent studying the plans, reading and rereading until each step becomes clear to you is time well spent.

If after all of your efforts, you are still unsure, by all means write or call Rutan Aircraft for builder support. Occasionally it may be necessary to speak with or write to Fred Keller who did the drawings and photos for these plans, particularly when it comes to interpreting the drawings themselves. Fred's telephone number and address is listed below. For obvious reasons, since he works during the day, Fred will be available for phone calls concerning builder support only on Monday, Wednesday and Friday from 6:00 p.m. to 9:00 p.m. We would appreciate it if you would be kind enough to only use this "builder support" number when contacting Fred on the days and times listed above.

Mr. Fred Keller,
12941 Hillside Drive,
Anchorage, AK 99516
(907)345-6745

COMPOSITE CONSTRUCTION EDUCATION

DO NOT SKIP THIS SECTION. Every hour you spend in this preparation section will save you five when you really start building your aircraft.

GENERAL

In this section you don't build any part of your airplane. What you will do is learn how to build your airplane the right way. This construction technique is radically different from anything you've done before (including building boats, surfboards, airplanes and gocarts), and you should assume there is only one correct way to do it. We've discovered lots and lots of wrong ways of doing things and have written the plans to keep you from repeating our mistakes. We insist that you do things our way. If you have a better idea, send it to us, we'll test, and if it really is a better idea we'll publish details in the "Canard Pusher".
This section will teach you all of the techniques required to build your airplane, show you what special tools you need and how to use them. The educational samples that you will build in this section are designed to give you experience and confidence in all of the techniques that you will use in the construction of your airplane. The steps in construction of each sample are arranged in sequence (as are the steps in construction of the actual aircraft parts) and you should follow the sequence without skipping any steps. You will learn the basic glass layup technique used throughout the aircraft, special corner treatments, foam shaping/cutting and joining methods.

Our video tape titled "Building the Rutan Composites" is very helpful in developing your technique. It is generally shown on Saturdays at RAF, or can be purchased from RAF.

TOOLS

There are certain tools which are necessary to complete the aircraft. Three lists of tools are provided here. The first is the absolute bare minimum required, sacrificing efficiency; the second is a recommended list for the best compromise of cost and work efficiency; the third is a list for the "Cadillac" of shops where ease of construction is more important than money. The non-common items are stocked by the Defiant distributors.

1. Basic Required Tools

Common household butcher knife.
Coping Saw.
Small open-end wrenches.
Sandpaper 40-grit, carborundum Aloxite Fastcut (50 sheets), also 220-grit, 320-grit and 400-grit (20 sheets each).
1 12" long #12 drill bit.
2" dia drum sander (coarse) for 1/4" drill.
Coarse rotary file bit for 1/4" drill.
Pliers.
1" putty knife.
Hacksaw.
Blade and Phillips screwdrivers.
Box of single-edge razor blades.
24" carpenter's level.
Carpenter's square.
Flet marking pens.
3-ft. straight edge.
200 eight-oz paper cups.
50 3-oz paper cups (unwaxed).
12-ft decimal steel tape (Stanley #61-112).
1/4" electric drill with #3, #10, #12, #21, #30, #40 and 1/4" drill bits.
#10-32 and 1/4-28 taps.
Roll of grey duct tape.
1" and 2" paint brushes (100 each).
6" plastic or rubber gloves.
Scissors.
Wire Brush.
Pop rivet puller.
Homemade balance for ratioing epoxy.
Wall thermometer 50 to 100°F.
1/4" hand drill.
Sears universal Protractor #9KT3995.
1 Hot Melt Glue Gun

Recommended Tools (in addition to those listed above)

Dremel-type miniature high-speed hand grinder with saw and router bits.
6" and 9" disc-type hand sander.
Set of 1/4", 1/2" chisels (wood).
Small set of X-Acto knives.
1/2" dia 100° counter sink (piloted for #11, #21 and #40).
6" machinist steel ruler.
X-Acto razor saw.
Box of wood tongue depressors to mix epoxy.
6-ft straight edge (piece of aluminum channel)
Cheap holesaw set or flycutter.
3/8" variable speed hand drill.
12" long drill bit 1/4".
Hand broom and brush.
Large commercial 12" scisors (Wiss #20W).
Sabersaw.
Bench-mounted belt sander.
Stanley sureform plane.
Square and half round files.
Several 6" C-clamps.
Vacuum cleaner (shop type).
10" 18 tooth/inch hand saw.
Approx 150 lb. of small weights*.
Hair blow dryer.
Epoxy ratio pump (Michael's Engineering dispenser).
90° Drill adapter.

3. For the First Class Shop (in addition to those above

Drill Press.
Vernier Caliper.
Air compressor with blow nozzle.
Orbital sander.
Drill sets #1 through #60 and 1/16 through 1/2 (1/64 increments).

Items Used Only Occasionally and Can Be Borrowed

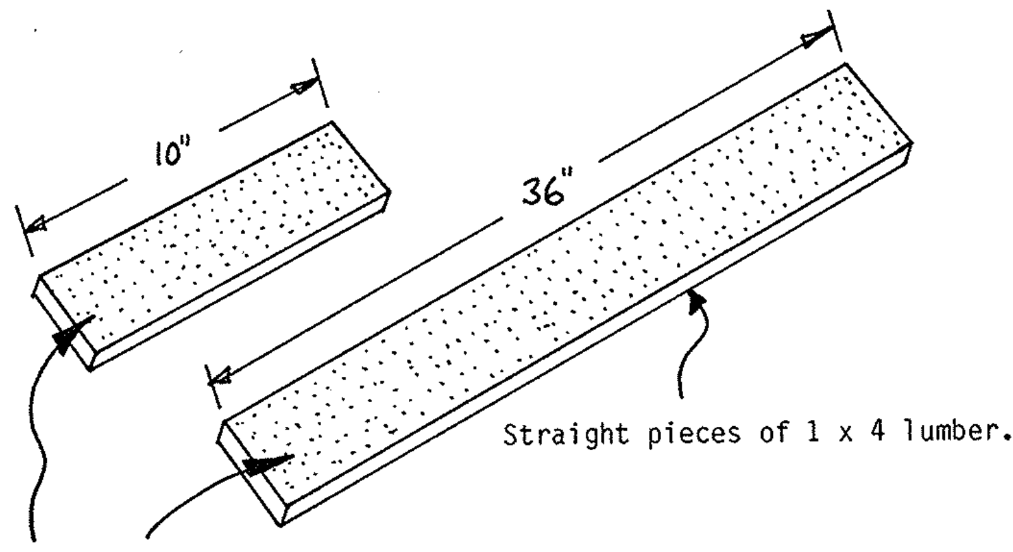
Nicropress Sleeve Tool.
1 dozen 1/8" clecos.
Hotwire voltage control.

*Weights are used to hold various parts down while epoxy cures. They are best in 5 to 15 lb. pieces. The items in the photo work great. We got them for 5¢ per lb. at a local scrap yard. Sand filled milk cartons also work well.

The following tools are ones you make:

Sanding Blocks

These are required in many areas during construction and for finishing. You may also use a "soft block", which is a block of the blue styrofoam wrapped with sandpaper.



40-grit sandpaper glued to both sides with rubber cement.

A lot of elbow grease is saved if you replace the sandpaper often.

Long Straight Edge

A long straight edge is not required but is handy to have. You can use a chalk line or string but this requires two people. There are several types of straight edges that you can use. You can buy a 6 foot level but that is perhaps in the "Cadillac" shop. You can buy aluminum channel at the hardware store or you can use wood. If you use wood you can go to the lumber yard and eyeball the boards until you find one that is straight. Another method is to buy a piece of 3/4" plywood sighting the edge to be sure it is straight and cut a 4" strip off the sheet. This will give you stable straight edge (for wood) and you have enough wood left over to build a cloth cutting table. If you use a board, 1" x 4" redwood or fir, check it for straightness after the weather changes.

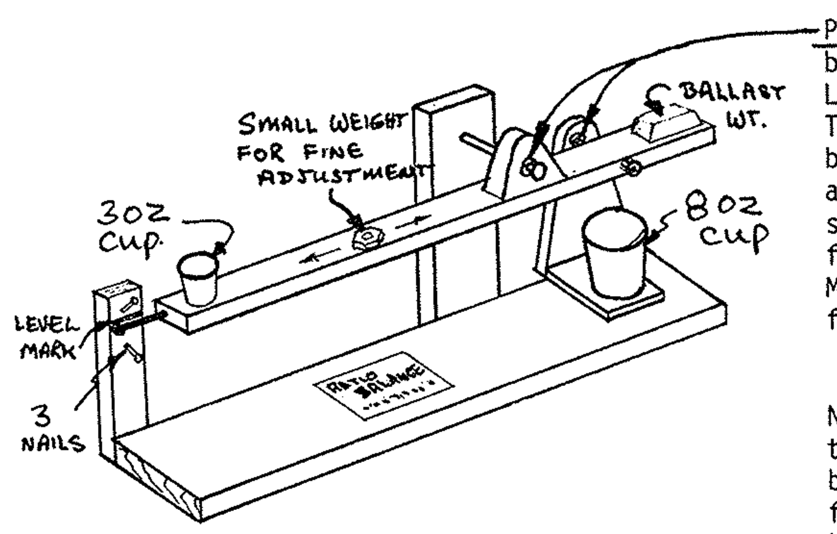
Epoxy Balance

Devices which automatically ratio the correct amount of resin and hardener and dispense it with the pull of a lever are available from Defiant distributors for approximately $150. These save time and epoxy. You can ratio the epoxy the way we did in building N78RA by building the following simple balance: (see drawings)

Cut out the 5-step instructions and glue to your balance - don't skip steps! Follow each step exactly every time you mix epoxy.

> RATIO BALANCE FOR RESIN/HARDENER
>
> 1. Place both empty cups as shown. Wet the hardener cup.
> 2. Adjust ballast weight to level mark.
> 3. Fill resin cup with desired amount of resin - 1 to 6 oz.
> 4. Add hardener to hardener cup to balance scale on level mark.
> 5. Pour the hardener into the resin cup and mix.

Cut the instructions out and glue them to your balance.

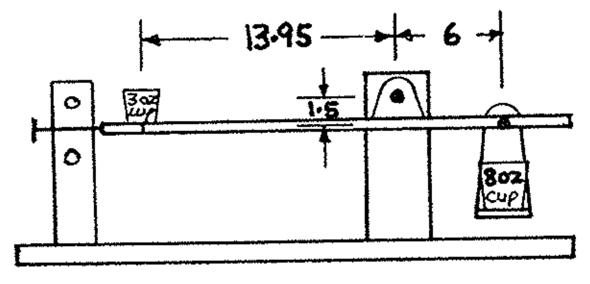


Pivots - metal tube bushings in wood. Loose fit on nails. The 1/8" diameter brass tube available at hobby shops is excellent for the bushings. Must be friction free.

NOTE: The metal tube for the pivot bushings can be cut from an empty ballpoint pen.

NOTE: Balance accuracy check:-

Simply put 43 nails in the hardner cup and 100 nails in the resin cup and check for level.



Safe-T-Poxy resin to hardner ratio is 100 parts to 43 parts by weight. By volume it is 7 parts resin to 3 parts hardner.

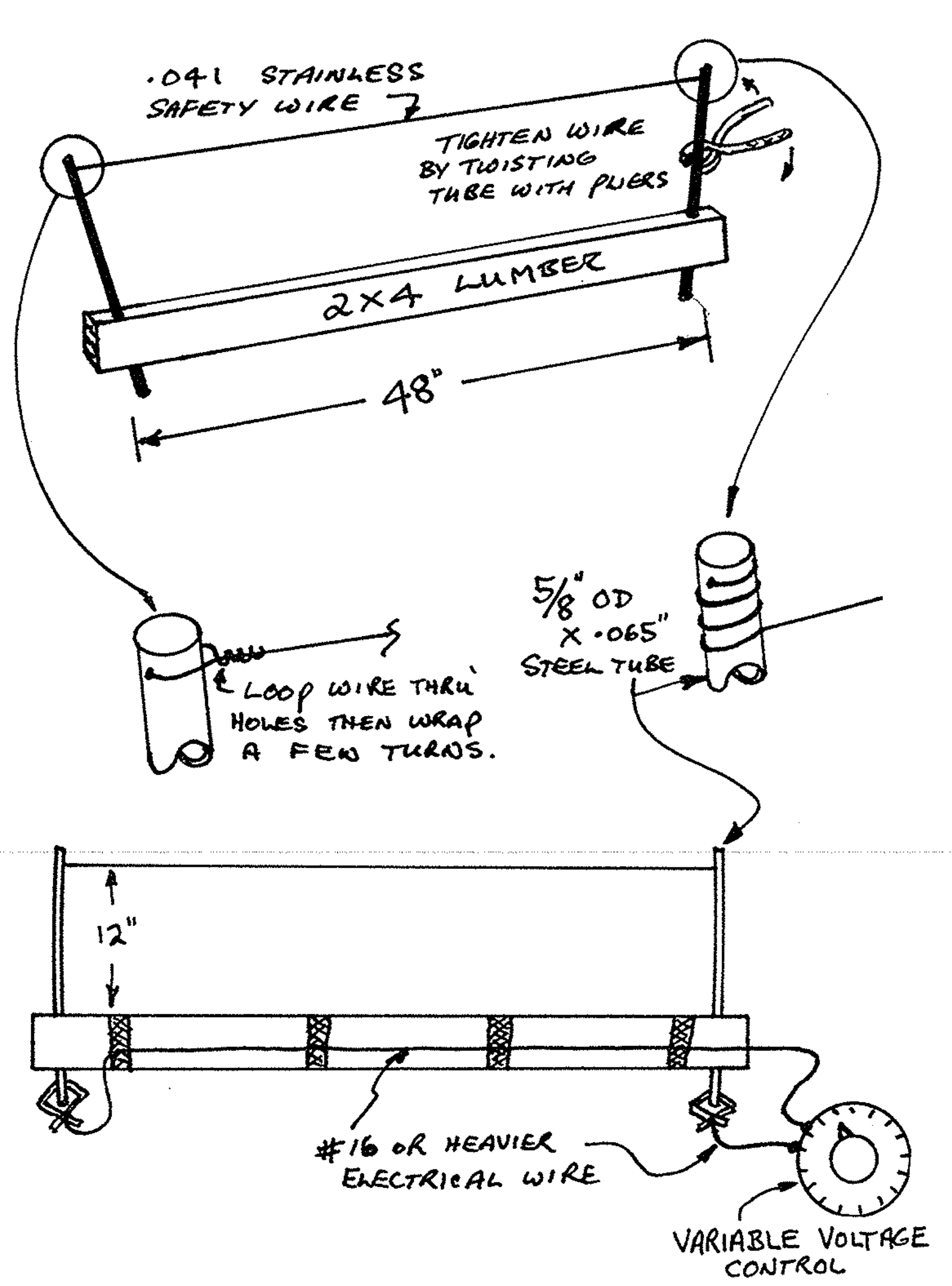
HOT WIRE CUTTER

You will need a hot wire cutter to carve all the foam cores for the canard, vertical stabilizer and wings. Refer to sketch.

The variable voltage control can be obtained from a Defiant distributor or you can substitute any controllable power supply to include the 14 to 20 volt range with at least 4 amp capability. An alternative is to borrow two 12-volt battery chargers or auto batteries and lash up the following device. The "A" blocks represent either a battery or a 12-volt battery charger with 4-amp capability.

THE CUTTER SHOULD ONLY BE USED ON THE BLUE, WHITE OR ORANGE STYROFOAM. A HAZARDOUS GAS IS EMITTED IF YOU TRY TO CUT URETHANE.

Adjust the current to obtain a wire temperature which will allow the wire to cut the foam at a rate of one inch every four to six seconds when pulled with a light load (less than 1/2lb). This can be checked


.041 STAINLESS SAFETY WIRE
TIGHTEN WIRE BY TWISTING TUBE WITH PLIERS
2X4 LUMBER
48"
5/8" OD X .065" STEEL TUBE
LOOP WIRE THRU HOLES THEN WRAP A FEW TURNS.
12"
#16 OR HEAVIER ELECTRICAL WIRE
VARIABLE VOLTAGE CONTROL

with a small scrap of foam. If temperature is correct, foam will have a smooth hairy surface. A cratered surface means too much heat. If the wire is too cold, the cutter will have to be forced hard, causing the wire to lag. Lag should not exceed 1/2" over th top and bottom of the wing and not over 1/8" around the leading edge. If the wire is too hot, it will burn away too much foam, making the part too small and will result in ruts in the foam if the wire is inadvertently stopped during the cutting. The wire should be tightened until the wire starts to yield. Check this by tightening the wire while plunking it listening to the sound. The pitch will increase until the wire yields.

JIG TABLE

You will need two tables 24" x 96" and two table 24" x 48" to enable you to make up from 24" x 48" tp 24" x 288" length tables to jig and build the wings and canard. Use a little care in making a flat, untwisted surface. See Page D-1 for a sketch of the tables Fred used. Set them up with the top 35 to 39 inches above the floor. Don't get carried away with surface finish, since you are going to be gluing blocks to them with Bondo and chiseling them off several times.

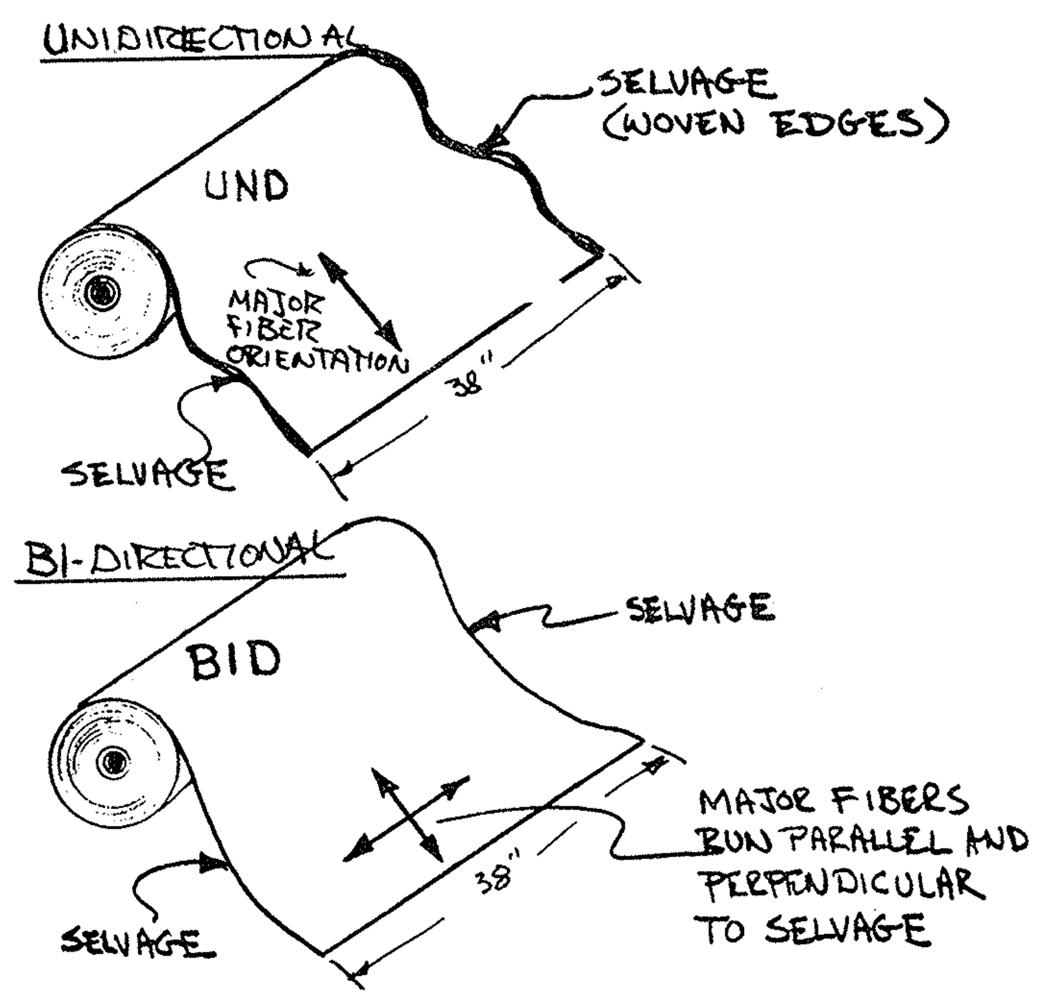
MATERIALS

The materials, processes and terminology used in the construction of the Defiant may be new to you unless you have built a moldless composite homebuilt in the last several years. This section is devoted to familiarizing you with the language, materials and techniques used in these plans. This information is basic to the construction of your airplane. You should study this section and be sure that you understand all of it before continuing.

There are six basic materials that you will be working with: fiberglass cloth, 'S' glass roving, epoxy, microspheres, flox and foam. Each material, its properties and uses will be discussed in detail. Basic processes using these materials will also be discussed.

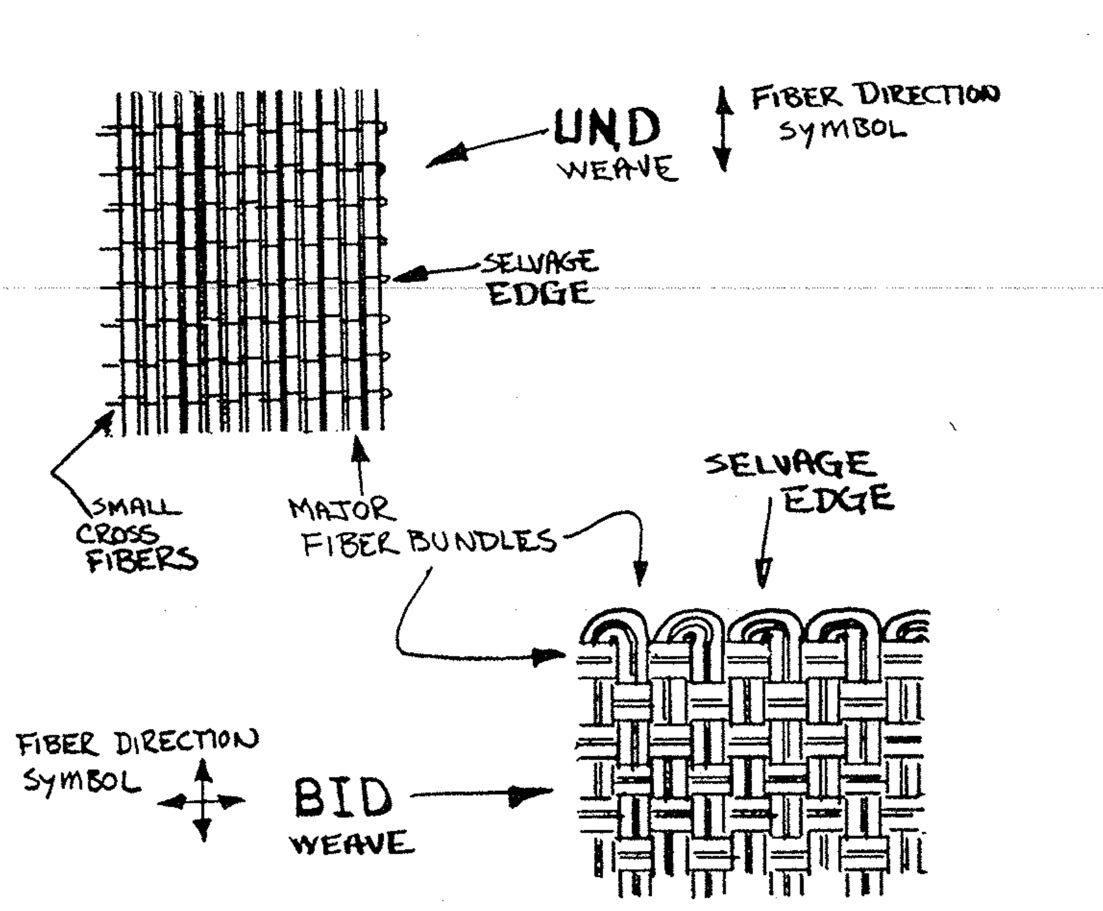
GLASS

The most basic structural material in your Defiant is glass cloth. Glass cloth is available commercially in hundreds of different weights, weaves, strengths and working properties. The use of glass in aircraft structures, particularly structural sandwich composites, is a recent development. Very few of the commercially available glass cloth types are compatible with aircraft requirements for high strength and light weight. Even fewer are suitable for the hand layup techniques developed by RAF for the homebuilder. The glass cloth used in the Defiant has been specifically selected for the optimum combination of workability, strength and weight.



The glass cloth in your Defiant carries primary loads and its correct application is of vital importance. Even though doing your glass work correctly is important, this does not mean that it is difficult. Good workmanship is a must, though, to achieve the design strengths.

Two types of glass cloth are used, a bi-directional cloth (RA7725BID) and a unidirectional cloth (RA7715UND). (Use the full part number for ordering your cloth, but for simplicity, the plans will use only the BID and UND designations). BID cloth has half of the fibers woven parallel to the selvage edge of the cloth and the other half at right angles to the selvage, giving the cloth the same strength in both directions. The selvage is the woven edge of a bolt of fabric as shown in the accompanying sketch. UND cloth has 95% of the glass volume woven parallel to the selvage giving exceptional strength in that direction and very little at right angles to it.



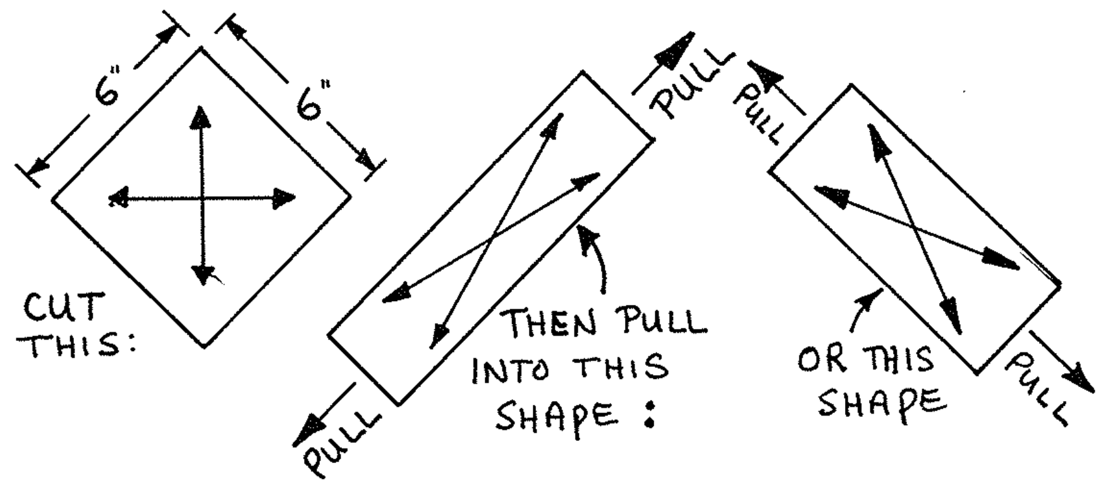
BID is generally used as pieces which are cut at a 45° angle to the selvage and laid into contours with very little effort. BID is almost always applied at 45° orientation to obtain a desired torsional or shear stiffness. UND is used in areas where the primary loads are in one direction and maximum efficiency is required, such as the wing skins and spar caps. Correct orientation of fibers is extremely important.

Multiple layers of glass cloth are laminated together to form the aircraft structure. Each layer of cloth is called a ply and this term will be used throughout the plans.

Marking and cutting the plies of glass cloth is a job that you will repeat often in the construction of your Defiant. Glass cloth should be stored, marked and cut in a clean area with clean hands and clean tools. Glass contaminated with dirt, grease, or epoxy should not be used. If your cloth roll ever gets water spilled on it, it must be discarded and not used on an aircraft structure. A clean, smooth surface is needed for marking and cutting. The area used for storing and cutting glass cloth should be separated from the aircraft assembly area because it will be exposed to foam dust, epoxy and other things which can contaminate the cloth. You will need a good sharp pair of scissors, a felt-tipped marker, a fairly straight board and a tape measure for marking and cutting. The small amount of ink from marking and numbering plies has no detrimental effect on the glass cloth.

In each step, the size, type and fiber orientation of each ply is given. Take the list to your glass cutting table, roll out a length of the appropriate cloth, straighten the selvage, mark all of the plies and cut them.

Now is a good time to stop reading long enough to go and cut a square ply of BID and see how easy it is to change its shape by pulling and pushing on the edges as shown in the sketches. Cut a square with the fibers running at 45° and pull on the edges to shape the piece.



It helps if you make fairly straight cuts but don't worry if your cut is within 1/2 inch of your mark. As you cut BID it may change shape, just as the square ply that you are experimenting with does when you pull on one edge. Plies that distort when cut are easily put back into shape by pulling on an edge. Rolling or folding cut plies will help keep them clean and make it easier to maintain their shape. If several plies are called for, it may help to number them before cutting. Save your clean scraps and make an effort to use them for smaller plies. If the cloth is spotted with epoxy, throw it away.

When cutting long strips or larger pieces of 45° BID, always roll or fold it so it keeps it shape when handled. When its applied it can be set on one end of the part and rolled onto it. If you pick up each end, it will distort and not fit the part properly.

The fiber orientation called for in each materials list is important and should not be ignored. UND is characterized by the major fiber bundles running parallel to the selvage and being much larger than the small cross fibers which run at right angles to the selvage. In BID the cross fibers are the same size as those running parallel to the selvage, giving BID an even "checker board" appearance. BID is commonly used for plies cut at 45° to the selvage. Your tailor would call this a "bias" cut. The 45° cut also makes it possible to make a ply slightly longer than originally cut by pulling on the ends or wider by pulling the sides. The 45° orientation is not critical; you do not need to measure it. Your eyeball of a rough diagonal (45° ± 10°) is adequate when either cutting or laying up the cloth.

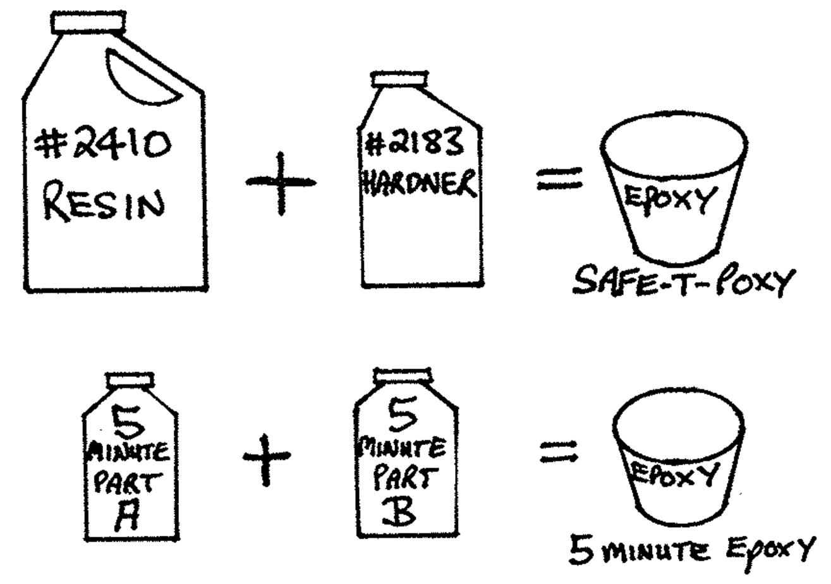
There is a difference in the way BID and UND are joined. When joining the edge or the end of BID and a BID ply it is necessary to overlap it one inch onto the ply it is being joined to. When joining UND across the major fibers it is lapped 1" per ply but when joining UND along the major fibers it is butted next to the piece it is joining, not overlapped. Also with UND it is not necessary to remove the slevage (edge of cloth) when making a wide layup such as a wing layup at 30°. Lay the first piece on with the selvage at 30° and butt the selvage of the next piece to it. With BID the selvage is always removed.

EPOXY

In recent years the term "epoxy" has become a household word. "Epoxy" is a general term for a vast number of specialized resin/hardener systems, the same as "aluminum" is a general term for a whole family of specialized metal alloys. Just as the "aluminum" in the spar of a high performance aircraft is vastly different from the "aluminum" pots and pans in your kitchen, the "epoxy" in your Defiant is vastly different from the hardware store variety.
Epoxy is the adhesive matrix that keeps the plies of load-carrying glass cloth together. Epoxy alone is weak and heavy. It is important to use it properly so that the full benefits of its adhesive capability are obtained without unnecessary weight. A large portion of your education in composite structural work will be spent learning how to get the full strength of an epoxy/glass mixture with the minimum weight. This section will discuss the terminology and techniques for working with epoxy resin and its hardener.

An "epoxy system" is made up of a resin and a hardener tailored to produce a variety of physical and working properties. The mixing of resin with its hardener causes a chemical reaction called curing, which changes the two liquids into a solid. Different epoxy systems produce a wide variety of solids ranging from extremely hard to very flexible. Epoxy systems also vary greatly in their working properties, some are very thick, slow pouring liquids and others are like water. Some epoxy systems allow hours of working time and others harden almost as fast as they are mixed. A single type of resin is sometimes used with a variety of hardeners to obtain a number of different characteristics. In short, there is no universal epoxy system; each has its own specific purpose and while it may be the best for one application, it could be the worst possible in another use.

The Safe-T-Poxy epoxy system used in the construction of your Defiant is tailored for the best combination of workability and strength, as well as to protect the foam core from heat damage and solvent attack. These systems are also low in toxicity to minimize epoxy rash.



The working and strength characteristics of an epoxy system are dependent on the resin, the hardener and on the amount of each in a given mixture. Epoxy systems are engineered for a specific ratio of resin and hardener. It is quite important that the proper mixture be obtained. An accurate balance or ratio pump must be used to accomplish this. A drawing of an inexpensive ratio balance is included in these plans. The mix ratio accuracy is important with Safe-T-Poxy. The 5 minute can be adequately ratioed by merely pouring a blob of Part A in a cup and adding a blob of Part B that looks the same volume before mixing. Never eyeball estimate Safe-T-Poxy, always carefully use the balance or pump.

Epoxy resin and hardener are mixed in small batches, usually 6 ounces or less, even in the largest layup. The reason for small batches is that, in large batches, as the hardening reaction progresses, heat is generated which speeds the reaction, which causes even more heat, which ends up in a fast reaction called an exotherm. An exotherm will cause the cup of epoxy to get hot and begin to thicken rapidly. If this occurs, throw it away and mix a new batch. The small volume batch avoids the exotherm. For a large layup, you will mix many small batches rather than a few large ones. With this method you can spend many hours on a large layup using epoxy that has a working life of only a few minutes. If the epoxy is spread thin as in a layup, its curing heat will quickly dissipate and it will remain only a few degrees above room temperature. However, in a thick buildup or cup, the low surface area to mass ratio will cause the epoxy to retain its heat, increasing its temperature. This results in a faster cure causing more heat. This unstable reaction is an exotherm. Exotherm temperatures can easily exceed the maximum allowable for foam (200 degrees F) and damage the foam-to-glass bond. The Safe-T-Poxy system has been designed to minimize this problem and in thicknesses of less than 1/8 inch, there is no danger of exotherm. However, do not try to fill a void inside a wing by pouring Safe-T-Poxy in a small hole to fill a large void, it will exotherm and cause a larger hole.

Unwaxed paper cups are used for mixing and ratioing resin and hardener. Convenient 8-oz. cups for resin are available from Defiant distributors. The hardener cups are the 3-oz. unwaxed bathroom paper cups available at any grocery store. Do not use waxed cups; the wax will contaminate your epoxy.

If you are using the homebuilt balance, follow this procedure. Place the resin (8 oz.) cup on the right cradle. The resin cup can be either a new clean cup, one with a little uncured epoxy left in the bottom, or a clean cup from a previous layup with hard epoxy in the bottom (smooth, not lumpy). Now, take a clean 3-oz. hardener cup - pour a splash of hardener into it then scrape the hardener back into the container. This gives the hardener cup a wet surface, so its remaining hardener will not be counted in the balancing. Now, place the wet hardener cup on the scale, check that it swings freely and balance it perfectly by moving the small weight. Epoxy is then poured into the 8-oz. cup (6-oz. or less). Hardener is then poured into the 3-oz. cup at the other end of the balance until the arm is level. When ready to mix, pour the hardener into the resin cup and mix completely. If you have the ratio pump, you simply put one cup under the spout, pump out the amount that you want and mix.

Mixing is done by stirring with a stick, being careful not to spill any. If you spill part of an unmixed cup, the ratio of resin and hardener may be inaccurate and it should not be used. Mix each cup for a least one minute. You should spend 80 % of your mixing time stirring the cup and 20 % scraping the sides to assure complete mixing. Do not mix with a brush. The bristles can soak up the hardener, changing the ratio. Use a tongue depressor or wood stick.

The working temperature has a substantial effect on the pot life and cure time. Very hot conditions will cause the cure to speed up. In cold working conditions the cure will be delayed and if it is cold enough, epoxy may not cure at all. Working temperatures must be between 70° and 100° F. A range of 75° to 85° is best. Be sure to get a wall thermometer (approximately $1.50 at any general store) to check the temperature of your work area. At 75° F, 5 minute must be used within four minutes, Safe-T-Poxy must be used within 20 minutes and in a cup the working time will go down as a mild exothem starts.

Cold epoxy results in increased time required to do a layup, since it takes longer to "wet" and to squeegee the cloth. A layup at 70° F may take almost twice the time as at 80° F. On most layups (except for joining foam cores) it is best to have 75° to 85° F room temperature and 90° to 100° F epoxy. Resin and hardener can be kept warmer than room temperature by keeping it in a cabinet with a small light bulb on. DO NOT store your resin or hardener on a cold floor if you plan to use it within the next several hours. If you let your shop get cold between working periods, keep some resin and hardener in the warmest place of your house for use on the next layup.

Sometimes Safe-T-Poxy hardner will have solids form in the bottom of the bottle. If this happens do not use the hardener. All of the hardener must be liquid before it is used. To use this hardener it is necessary to heat it up and stir or shake it slightly. To do this heat some water on your kitchen stove in a large pan with the hardener in the pan of water. Move the bottle around to be certain not to melt the plastic container. When the water has just started to boil pull the hardener out and slosh it around. This should disolve all of the sediment in the bottom. If not put it back in the water for a few minutes and then shake it again.

Save your mixing cups, as they can be used as a quality check of your epoxy. After a day or two take a sharp knife point or scribe and scratch at the face of the epoxy in the cured cup. If the epoxy cured properly the scribe will make a white scratch mark. If the epoxy has not cured, the scribe will make a dull ridge, indicating a soft surface. If this occurs the epoxy is not cured, either due to inadequate time or temperatures, or bad mixing or bad epoxy.
Temperature is very important in working with Saf-T-Poxy. If you are working in a garage in the winter, the room must be heated up well in advance of the start of your layup. The foam blocks are a very good insulator and so it can take as long as four hours for the foam to warm completely to room temperature. Start heating your work area and all materials well in advance of starting your layup.
A hair dryer is also very helpful to use during a layup. If you are working toward the bottom of the temperature range you can speed the wetting of the cloth with a few light passes of your hair dryer while running a squeegee across an area of the layup. Care must be taken when using this technique so as not to get an area too hot. Also, when you have heated the epoxy up the squeegee will remove it easier, therefore it is possible to get the layup too dry. But the conservative use of the hair dryer can be very helpful.

MICROSPHERES

Microspheres are a very light filler or thickening material used in a mixture with epoxy. Micro, as the mixture is called is used to fill voids and low areas, to glue foam blocks together and as a bond between foams and glass skins. Only 3M 1323, 500 glass balloons are usable in the Safe-T-Poxy. This type will be supplied with your kit and can be ordered separately from your Defiant distributor. Quartz Q Cell balloons if used with Safe-T-Poxy will slow the cure time by as much as three days. When the cure is complete, the structural integrity is satisfactory but the time required is not. Micro ballons must be kept dry. If moisture is present it will make them lumpy. Bake them at 250 degree then sift with a flour sifter to remove lumps. Keep the microballoon container covered.

Micro is used in three consistencies: a "slurry" which is a one-to-one by volume mix of epoxy and microspheres, "wet micro" which is about two-to-four parts microspheres by volume to one part epoxy and "dry micro" which is a mix of epoxy and enough microspheres to obtain a paste which will not sag or run (about five parts-to-one by volume). In all three, microspheres are added to completely mixed epoxy.
You do not have to accurately mix the microspheres; just dump them in until the desired consistency is obtained. Micro slurry is used to paint over foams before glass cloth is applied over them. Slurry is almost the same viscosity as the pure epoxy and is runny enough to apply with a brush. However, the easiest way to apply slurry is to pour it onto the surface and spread it out evenly using a squeegee. When skinning pour-in-place urethane foam use a full thick coat of slurry. Inadequate slurry on urethane can result in a poor skin bond. Wet micro is used to join foam blocks and while it is much thicker than slurry, it is still thin enough to sag and run (like thick honey). Dry micro is used to fill low spots and voids and is mixed so that it is a dry paste that won't sag at all. In all three micro types, you do not measure, just add microspheres until the desired consistency is obtained. Use micro only as specifically shown - never use micro between glass layers.

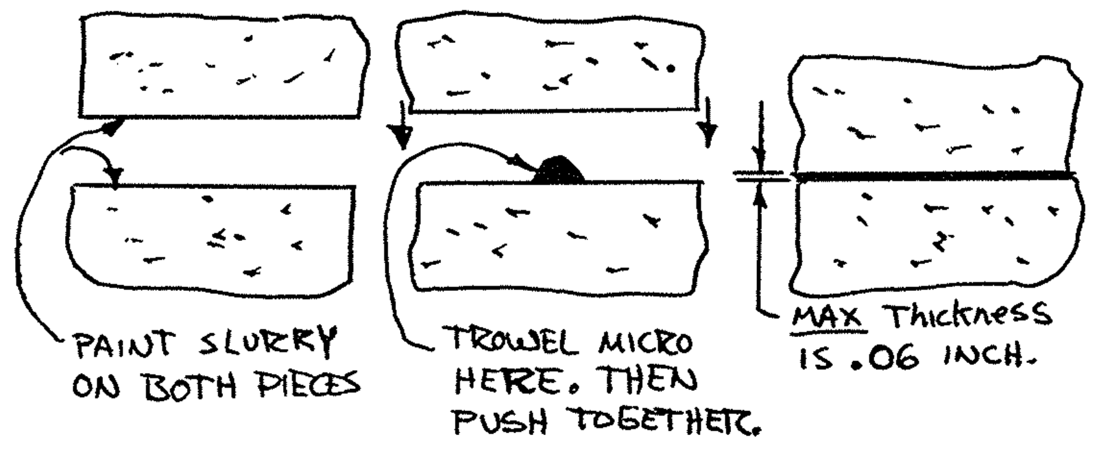
Joining Foam Blocks with Microspheres/Epoxy

Always use the following method to join foam blocks. This is extremely important. Always use Safe-T-Poxy.

1. Check that the foam blocks fit closely together. If there are voids over 1/16 inch, sand to fit, or fill the void with a sliver of foam.

2. Paint a light coat of micro slurry on both surfaces. If joining foam to fiberglass, paint pure mixed epoxy (no microspheres) on the fiberglass surface and micro slurry on the foam surface.

3. Refer to the sketch and trowel wet or dry micro in the center of the joint. Thus, when joined the micro is pushed outward expelling (rather than trapping) air. If the fit is excellent use wet micro. If it is open enough and vertical such that epoxy may run out, use dry micro.


PAINT SLURRY ON BOTH PIECES
TROWEL MICRO HERE. THEN PUSH TOGETHER.
MAX Thickness IS .06 INCH.

4. Push the two pieces together, wiggling each to move the micro toward the surfaces. Be sure the micro is no thicker than 0.1 inch at any place, to avoid exotherm. Wipe off any excess. Do not be concerned if the micro does not completely reach the surface. That void can be filled immediately before skinning the part.

FLOX

Flox is a mixture of cotton fibers (flocked cotton) and epoxy. The mixture is used in structural joints and in areas where a very hard durable buildup is required. Flox is mixed much the same as dry micro, but only about two parts floxs to one part epoxy is required. Mix in just enough flox to to make the mixture stand up. If "wet flox" is called out, mix it so it will sag or run.

When using flox to bond a metal part be sure to sand the metal dull with 220 grit sand paper and paint pure mixed epoxy (no flox) on the metal part.

A flox corner is a structural joint which is in the shape of a triangle from the end view and the side length will be called out. If only one side length is called out assume the other to be the same. When removing foam to install a flox corner be very careful not to cut the skin but you must remove the micro that was slurried onto the foam when the skin was applied. There are two places where this type of joint is used. First when there is a 90° corner and second at the trailing edge of the rudder where you are trying to make a very tight wrap. A flox corner will give the corner some extra strength.

BONDO

Throughout these plans the term "Bondo"is used as a general term for automotive, polyester body filler. Bondo is used for holding jig blocks in place and other temporary fastening jobs. We use it because it hardens in a very short time and can be chipped or sanded off without damaging the fiberglass. Bondo is not used for contouring or filling because of its heavy weight.

Bondo is usually a dull gray color until a colored hardener is mixed with it. The color of the mixture is used to judge how fast it will set. The more hardener you add, the brighter the color of the mixture gets and the faster it hardens. This simple guide works up to a point where so much hardener is added that the mixture never hardens.

Follow the general directions on the Bondo can for fast setting Bondo. Mixing is done on a scrap piece of cardboard or plywood (or almost anything) using a hard squeegee or putty knife. A blob of Bondo is scooped out of the can and dropped on the mixing board. A small amount of hardener is squeezed out onto the blob and then you mix to an even color. You will mix the blob for about one minute. You will then have two to three minutes to apply it before it hardens.

Be sure to clean the board and putty knife off before the Bondo is completely hard. Acetone will clean Bondo off your putty knife and squeegee if it is not completely hardened.

Throughout these plans you are asked to Bondo boards to cured epoxy such as wing skins. When joining a fixture at 90° to your skins it is better to use several small dabs than one large one. These should be about 1/2" x 1/2" forming a triangle. When joining a layup to a flat table or board it is best to use an amount that when fully squeezed between the parts, spreads to about the size of a quarter.

R.T.V. Silicone Rubber

This product is used to hold things in place that generally are subject to heat up to 450° F, or vibration. R.T.V. sticks well to sanded steel or aluminum and sanded fiberglass parts. The general use of this material is to hold down fuel lines or stick parts to an engine. We have tested GE brand in clear or white. Product # GE2567-012 or GE 361. Caution: Silicone will dissolve in fuels.

FOAM

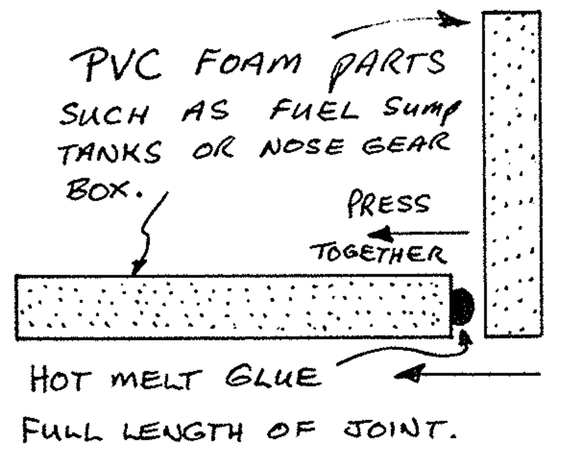
Three different types of rigid, closed-cell foam are used in your Defiant (and several densities). A low density (2 lb/ft^3), light blue, white or orange styrofoam is used as the foam core of the wings, winglets and canard. The styrofoam is exceptional for smooth hotwire cutting of airfoil shapes.

The large cell type used provides better protection from delamination then the more commonly used insulation-grade styrofoams. This styrofoam also has greater peel strength than the standard blue styrofoam sold by some insulation distributors. Do not confuse styrofoam with white expanded polystyrene. This is the material white foam ice chests are made from and its properties are not accceptable. The blue foam used in your flying surfaces was selected for a combination of reasons, hot wire cutting ability was an important factor. Never hot wire other types of foam, urethane will give off poisonous gases. Buy your foam from a Defiant distributor and you will receive high quality materials that have been tested to do the job.

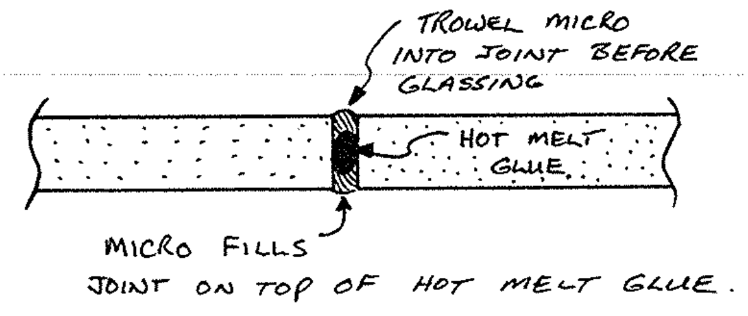
Devinicel Poly Vinyl or PVC is used in the bulkheads of the fuselage, nose gear box, sump tanks, etc. The weight of the foam used in the bulkheads is 2.9 lb/ft^3 (type H45). This foam has very good peel strength and compression strength. Again PVC foam comes in many types and densities. Be sure you order from a Defiant distributor so you receive products which are recommended for the job.

HOT MELT GLUE

The hot melt glue gun (Thermogrip or similar) is a very handy tool for quickly jigging fixtures to tables, or even glass parts together, such as the cowlng to the fuselage etc. The commonly available thumb operated hot glue guns are ok, but the more expensive trigger operated guns such as the top of the line Sears model, is more desirable. The main reason for having a good quality gun is that a lot of the PVC foam parts in a Defiant are glued to each other using hot melt glue. A good example is the sump tanks. Cut all of the PVC foam parts out of the tan colored Divinicel foam. Run a bead of hot melt glue full length down an edge of the bottom, quickly place the side at 90° to this edge. Press them together and at the same time move them relative to each other as shown to spread the hot melt glue. Hold the two parts in the correct relationship for a few seconds and presto! They are firmly glued together. Glue the remaining three sides to the bottom and to each other in the same way. When you are ready to glass the inside of the fuel sump "foam box", be sure and squeegee slurry down into the joints before laying up the glass skin.


PVC FOAM PARTS SUCH AS FUEL SUMP TANKS OR NOSE GEAR BOX.
PRESS TOGETHER
HOT MELT GLUE FULL LENGTH OF JOINT.

Anywhere that two pieces of PVC foam (will not work on styrofoam) are required to be joined, you can use the hot melt glue and then later when glassing over the joint, trowel slurry or wet micro into the voids in the joint.


TROWEL MICRO INTO JOINT BEFORE GLASSING
HOT MELT GLUE
MICRO FILLS JOINT ON TOP OF HOT MELT GLUE.

Pour in Place Urethane foam. This is a two part liquid which when mixed together will foam up into a solid at 2 lb/ft^3 liquid. X-40 foam is the brand we have tested. This foam is a strong skin sensitizer so it is imperative that gloves be used when working with this material. Read the lable and follow mixing instructions. X-40 foam cures with heat so it kicks faster on a hot day. Mix small batches the first couple of times you use it to get the feel for how fast it goes off and how much to use. Successive layers can be used one after the other before curing or after cure to get a full build. Watch when trying to fill an area that you leave room for the excess to escape.

Scrap pieces of styrofoam can be used as dams to contain the X-40. When you are building a shape such as in the wing root fairing you can glue pieces of styrofoam together using X-40. After mixing the X-40 apply with a brush to the foam blocks and set them in place. This foam when cured can be worked with standard wood working tools. Sanded with standard sandpaper and cut with a knife or saw. Never, however, use this foam in any application that will be hot wire cut as this will emit a poisonous gas.

URETHANE FOAM SHAPING

One the real treats in the construction of your airplane will be shaping and contouring urethane foam. Urethane is a delightful material that shapes with ease using only simple tools. A butcher knife, old wire brush, sandpaper and scraps of the foam itself are the basic urethane working tools. A vacuum cleaner is convenient to have handy since working urethane produces a large quantity of foam dust. The knife is used to rough cut the foam to size. The knife needs to be kept reasonably sharp; a sander or file is an adequate knife sharpener since it is a frequent task and razor edge is not necessary. Coarse grit sandpaper (40 grit) glued to a board as shown on B-1 is used for rough shaping outside contours. Inside contours or "dishing" is done by using a ragged old wire brush to rough out the bulk of the foam and following up with a scrap foam piece to smooth the surface. The foam scrap conforms to the shape of the surface resulting in a very smooth contour.

Outside contours are roughed out with a sanding block and finished using a foam scrap. Dry micro and flox are used to fill voids and pot fasterners in a number of places. All foam shaping should be finished before any micro filling is done, because the filler is much harder than the foam and this makes smooth contouring very difficult. Your best carving template is your eyeball; an occasional check on the depth of a contour is about the only measurement necessary.

Keep your shop swept reasonably well. The foam dust can contaminate your glass cloth and your lungs. Use a dust respirator mask while carving urethane. Try not to aggravate the family by leaving a green foam dust trail in to the house.

HOT WIRE CUTTING

The airfoil-shaped surfaces of your Defiant are formed by hot wire cutting the blue styrofoam of 2lb/ft^3 density. The hot wire process gives airfoils that are true to contour, tapered and properly twisted with a minimum of effort and the simplest of tools. The details for making your hot wire saw were shown on page B-1.

The hot wire saw is a piece of stainless steel safety wire, stretched tight between two pieces of tubing. The wire gets hot when an electrical current passes through it and this thin, hot wire melts through the foam. By making smooth steady passes, the hot wire gives a smooth, even surface. The foam offers little resistance to the hot wire's passage. A variable voltage control is used to supply the electrical current that heats the wire.

To get a smooth accurate cut, a hot wire template is needed. Hot wire templates can be made from 1/16 to 1/4 inch plywood or formica, or .032 to .064 sheet metal. It is important to have smooth edges on the templates. A rough edge may cause the wire to hang up and burn into the foam excessively. Templates are required on both ends of the foam being cut. The size, shape and orientation of the two templates is varied to taper and twist the foam core as required. The plan form (span and sweep) is set by squaring up the foam block before the templates are used. In general, the trailing edge of the wing is the reference; a "trim line" on the templates is lined up on the trailing edge.

Full size template drawings are provided in the plans. To make your templates, just glue the template drawings to a piece of formica, plywood or sheet metal and trim to the contours shown. There are a number of markings on each template which aid in the alignment and cutting of the foam core.
Each template has a waterline (W.L.) marked on it which is used to align the twist of the foam core. Each template's waterline is leveled using a carpenters bubble level. This assures that the relative twist at each template is correct. The template is then nailed to the foam block to obtain the correct plan form; a foam trim line is provided near the trailing edge of each template which is lined up on the foam edge before cutting. It is necessary to check the straightness of the trailing edge of the foam block. This edge must be straight.

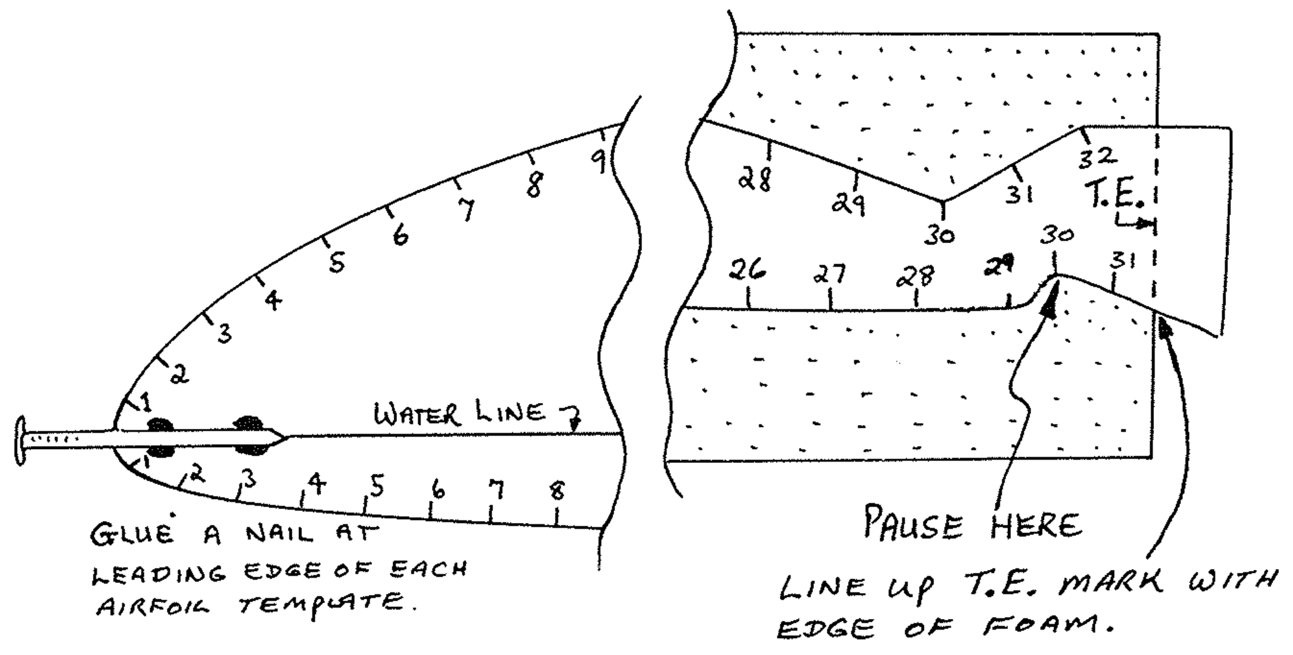
Each rib template has numbered marks running from the leading edge to the trailing edge. These are called "talking numbers". When the foam cores are cut into their airfoil shape, the talking numbers are used to assure that each end of the hot wire is co-ordinated to obtain the correct, tapered airfoil. The person calling the numbers should be at the largest template. A typical cut would sound like this: "Resting on the tab at the foam, moving forward, entering foam now - one, half, two, half, ... 34, half, 35, half, 36, coming out of the foam and pausing on the tab, wire's out". As the cut is made, the person on the small rib follows the numbers, passing over them as he hears them called out. Pause marks are indicated in places where it is necessary to pause for a couple of seconds and let the hot wire's center lag catch up with the ends.

Preparing a foam block for an airfoil is begun by trimming the retangular foam block to the basic dimensions for the correct plan form. These "trim" cuts are made using two straight edge trim templates. The best way to get straight edge trim templates is to buy a 36" aluminum yard stick and cut it in half. Drill holes to fit your 40 nailes every inch. You do not need to nail this every inch but it is good to have lots of places to nail it.

The templates are held against the foam by nails through the template into the foam. Enough nails should be used to hold the template firm so that it won't move when the hot wire is held against it.

The use of the hot wire saw is a simple thing if your equipment is set up properly. Proper wire tension and wire temperature should be maintained for good cutting. The wire tension should be tightened after the wire is hot by twisting one tube with a pair of pliers. The wire should be hot enough to cut one inch of foam in four to six seconds without having to force the wire. A wire that is too hot will burn the foam away excessively. To cool an over-heated wire, simply turn your voltage control to a lower voltage setting. If you use a battery charger, you will have to add length to the wire. To warm up a cool wire, just increase the voltage setting or, with the charger shorten the wire.

When the wire is heated away from the foam it will become hotter than when it is in the foam. To avoid excessive burndown at the start of a cut rest the wire against the foam on the part of the template which is sticking out of the foam. Then turn the wire on and with light pressure in the direction of the cut wait until the wire starts to melt into the foam. Although the foam offers only mild resistance to the hot wire, a long cut will cause the middle of your wire to lag behind the ends. Wire lag can cause problems in tight curves like the leading edge of an airfoil. To reduce lag there, the cutting speed is reduced to about one inch in 8 to 10 seconds. The airfoil templates have notations in the areas where reduced speed cutting is necessary to allow the lag to catch up completely.
The most common hot wire error is wire lag which causes a bow in the leading edge. The following method solves this problem and thus we recommend you use it for cutting the canard, wings and vertical stabilizer. Instead of making one cut all around, glue nails on the templates at the waterline at the leading edge as shown. Now, cut the core in two passes: one from the leading edge up over the top to the trailing edge, the other from the leading edge (under the nail) down under the bottom to the trailing edge. The thin "flash" of foam left on the leading edge due to the thickness of the nails is easily removed with your butcher knife. The result is a perfectly straight leading edge. Care must be taken to assure that both ends simultaneously approach the template at the leading edge. Use the following vocal commands "wire is moving toward the nail, now resting on the nail 1/2 inch from the template (confirm both ends in that position), moving toward template 1/4 inch away, 1/8" away, on the template, moving up X (talking number) , Y (talking number)....". When approaching the trailing edge overlap notch (see sketch) slow down and pause 3 seconds in the notch to assure a full, sharp , accurate surface for the skin overlap.


1
2
3
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WATER LINE
GLUE A NAIL AT LEADING EDGE OF EACH AIRFOIL TEMPLATE.
28
29
30
31
32
T.E.
26
27
28
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30
31
PAUSE HERE
LINE UP T.E. MARK WITH EDGE OF FOAM.

The hot wire should be guided around the templates with light pressure. Pushing too hard against the template may move them or flex the foam block which results in an under cut foam core.

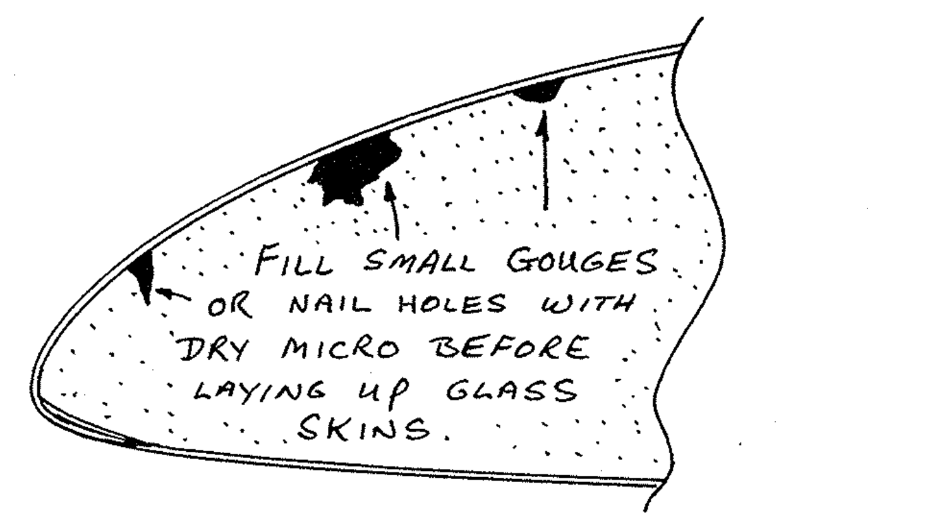
The correct set-up is just as important as using the correct tools and materials. Foam is a fairly flexible material and an improper set-up can cause deflection. The foam block should be well supported at each end, so that it does not sag and does not move around while being cut.

You need clearance for the hot wire cutter to pass by the table and the weights used to hold the foam steady.

When applying weights, set the foam core on your table and weight both ends near the hot wire templates.
We use lead shot bags, 25 lbs. on each end of each core. Once you have nailed a set of templates on a foam block do not move the templates or weight on the foam blocks, until the core is completely cut out. If you cut the top of a core then move the block and then cut the bottom, you will not necessarily have a core that is the right shape.

Foam is manufactured in sizes that are often too small to get a solid core from a single block. If it is necessary to use two foam blocks to get the size required for cores, these blocks have to be joined using an epoxy/microspheres mixture. The hot wire won't cut through the micro joint, so all of the hot wire cutting is done with the blocks temporarily joined. Nails or blobs of 5-minute epoxy are used for temporary foam joints, but the hot wire won't cut through these. Thus they have to be placed carefully so that the wire doesn't have to pass through them.

Do not be overly concerned if you don't make perfect foam cuts: ridges on the foam core from inadvertently lifting the hot wire off the templates are easily faired in with a sanding block. A less-than-perfect leading edge can be blended in by sanding after the foam core is assembled. Gouges in the foam can be smoothed and filled with dry micro to contour after applying the glass skins. The foam is too expensive to throw away because of a minor gouge.


FILL SMALL GOUGES OR NAIL HOLES WITH DRY MICRO BEFORE LAYING UP GLASS SKINS.

A finished foam core may warp out of shape after it is removed from the original block. This is due to internal stresses in the foam from the manufacturing process and is no cause for concern.

A warped core is simply weighted into the jig blocks and shimmed straight. Once the skin has been installed, the foam is held firmly in position.

GLASS LAYUP

The glass layup techniques used in your Defiant have been specifically developed to minimize the difficulty that glass workers have traditionally endured. Most of the layups that you will do, will be on a flat horizontal surface without the molds, vacuum bags and other special equipment that are common in glass work. The layups that you do will all cure at room temperature; no ovens or special heating is required. If you have suffered through a project that requires you to build more molds and tools than airplane components, then you are in for a real treat.

The techniques that you will use are very easy, but they still need to be done correctly. 90 % of the work that you will do is covered in the next few paragraphs, so make sure that you read and understand this section very well. If you learn these basics, your airplane will be VariEze indeed. If you skip over this information, you will probably end up very frustrated.

Step I: Personal Preparation

Before you get started with a layup, plan ahead. Some major layups take several hours and before getting your hands in the epoxy, its a good idea to make a pit stop at the restroom.

Do not start a large layup if tired. Get some rest and do it when fresh. Its best to have three people for any large layup, two laminators and one person to mix epoxy. Be sure the shop is clean before you start.

Take the recommended health precautions (discussed later in detail) using gloves or barrier skin cream. Get your grubby, old clothes on or a least a shop apron. Make sure that your tools are clean from the last layup and ready to use. Your working area should be between 70° F and 95° F. Best results are obtained at 75° to 85° F. Below 70° the epoxy is thicker making it more difficult to wet the cloth. Above 85° F, the possibility of an exotherm is greater.

Step 2: Cut Fiberglass Cloth

The fine points of glass cutting have been covered earlier. Just remember that there is not any requirement to cut accurate dimensions. Cloth dimensions are given well oversize. You scissor trim them as you go, while laying the cloth up. It is a good idea to keep two pair of scissors: one clean and in the glass storage area and one in the shop that gets epoxy on it. After cutting, roll or fold the material; keep it clean and handy for the layup.

Step 3: Prepare Surfaces

The only difference between layups over different materials is in surface preparation. The layup over foam will be covered here since you will be doing more of it and other surface preparations will be covered separately.

The foam surface is prepared by leveling uneven areas with a sanding block and brushing or blowing any dust off the surface. Use compressed air or a vacuum to remove dust.

Now is the time to accurately check that the foam core is the correct size, shape and contour. Refer to the section views of the part - be sure your core looks exactly like that on the section view. Lay a 12-inch straight edge spanwise on all critical areas of the flying surfaces and be sure you don't have any high or low places or joggles. Measure any areas that involve fiberglass buildups to check for correct depth. Build up is 0.009 inch per ply for UND and 0.013 inch per ply for BID.

Step 4: Mix Epoxy and Paint Surface

Mix epoxy only when needed, not before. Epoxy, micro and flox may be needed at various stages, so you may need several cups. If you are laying up over cured fiberglass, paint a liberal coat of epoxy on the surface.

When laying up over styrofoam, PVC foam or urethane foam, paint a liberal cost of micro slurry on the surface, before laying on the first ply. The slurry can be poured on the foam and spread thin with a squeegee or it can be brushed on with a brush. Squeegee excess slurry off the foam. You do not want the slurry to work up between the layers of cloth with stippling and squeegeeing. Then, fill any dings or gouges in the foam core with dry micro.

Step 5: Lay on the Cloth

To lay the cloth on, you need to know which direction the fibers of the cloth will run. You are told to lay them on usually 2 plies one at +30° to some named reference point such as a shearweb or T.E. and a second ply at -30° to the same reference.

Lay on the cloth in the specified orientation. Pull the edges to straighten the cloth out and to remove wrinkles. Maximum strength and stiffness is obtained if the fibers are not wavy or wrinkled. If the cloth is to be applied around a sharp corner, you will find the job easier to do if the fiber orientation is at 45° to the corner. Do not get depressed if the layup looks like a hopeless mess at this point. Press on with patience and things will work out fine. To remove wrinkles, study the direction of fibers, follow the fibers to the outer edge of the cloth and pull on the outside edge. Pushing a wrinkle off the part is incorrect. Once the part is free of wrinkles use a squeegee and make light passes from the center outwards to smooth the cloth.

The better you lay the cloth on the part the first time, the easier the straightening will be. Take extra care laying it on. If you are applying UND, have a helper hold the roll in position to one side of the part and you can pull the cloth off the roll over the part. Then you both set the cloth down on the part, come around and cut the cloth free of the roll leaving a little extra to trim later. Once you try this a couple of times you develop the knack and can lay the cloth on so it needs very little adjustment.

Step 6: Wetting out the Cloth

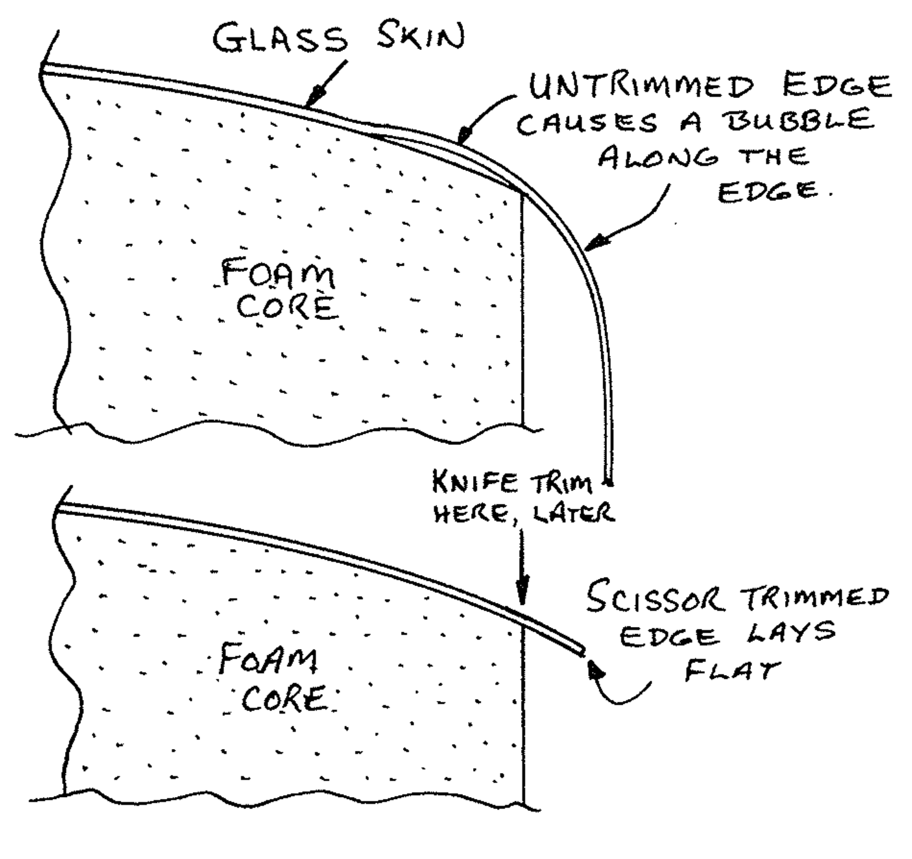
Once the cloth is on the part you will notice some of the epoxy in the slurry will wet out blotches of the cloth. Apply more epoxy on a larger layup by pouring a fresh mixed cup onto the part and squeegeeing it out to as much area as you think it might cover quickly. Get the epoxy spread out while it is still above room temperature.

On this first fast spreading of the epoxy do not take too much care to cover all the cloth, just get it spread out. Once you have the epoxy spread out come back and squeegee for the proper amount of epoxy over the surface, respreading to cover and wet out the area properly. If you start to work in a small area, working until that area is perfect and then onto another small area, you will never get the epoxy out of your cloth before it begins to cure, and you will never finish your first layer of cloth on the wing before it has cured. If this is a one ply layup, squeegee until a light pass will not run a ridge of epoxy in front of the squeegee as you pull it. Also look for air in the layup which can be seen as tiny flecks or bubbles. If you see this and squeegeeing does not help, try either fresh mixed hot epoxy or light strokes with a hair dryer. If this is a multiple ply layup you do not have to have all the excess epoxy up before the next ply goes on. Layup the second ply and squeegee the cloth to draw up any excess from below before applying fresh epoxy. If you use this method do not keep putting wet plies on and think you can draw it all up on the top ply.

Dry each ply out by squeegeeing the new cloth then add new epoxy. If the epoxy comes through but does not wet the cloth out use light passes with a hair dryer. Remember that you only want to add 5 to 10° F to the surface temperature of an area of your core. Do not overdo it or you can dry it out too much. Do not squeegee too hard as this can starve the layup also. A brush is used to wet out small areas or curved areas where you cannot get a good stroke with a squeegee. A brush can be used to remove air from the layup by stippling.

This is a vertical light stabbing motion with the brush. This technique is useful for wetting out small areas and corners and perhaps a problem area on a wing. Do not try and stipple out a whole wing, it takes much longer than using light passes with a squeegee. A brush can be used to pick up excess epoxy in small areas or corners by drying the brush out as much as possible. Hold the brush on edge and run the brush down past the edge of the cup several times. Now the brush will pick up a small amount of excess epoxy. This is a very slow way to remove excess epoxy but useful in corners and tight areas. Another tool many people find useful is a stipple roller. This is used for spreading the epoxy and stippling out the air. It is however a good idea to check your layup with a squeegee for excess epoxy.

As you wet out each ply, scissor trim to within 1/2" of any overhang (trailing edge, etc.). This 1/2" will be knife trimmed after the layup cures. If an over hanging ply isn't trimmed, it lifts the edge up and makes a bubble. After scissor trimming, restipple the edges to be sure there are no voids. Wet the cloth beyond the trim line at least 1/4" to allow easy knife trimming later.


GLASS SKIN
UNTRIMMED EDGE CAUSES A BUBBLE ALONG THE EDGE.
FOAM CORE
KNIFE TRIM HERE, LATER
SCISSOR TRIMMED EDGE LAYS FLAT
FOAM CORE

Step 7: Squeegeeing

Squeegee out excess epoxy. This involves drawing a plastic or rubber squeegee over the layup as shown. Plastic squeegees (scrapes) are available at any paint store. If excess epoxy exists, it will be pushed off the edge of the piece. Remember, excess epoxy is much better on the floor than on the airplane. It is possible to squeegee too hard and make the layup too dry. If this occurs, the surface will appear white, indicating the presence of air. If this occurs, wet the cloth by painting on a little epoxy and squeegeeing it down into the layup. The best quality layup is obtained if each layer of a multi-layer is squeegeed.

The finished layup should appear smooth and brown so that the weave of the cloth is clearly visible, but not so dry that any area appears white in color. If you've done an excellent job, the weight of resin will be about 1/2 of the weight of cloth used.

To check if there is too much epoxy in the layup, pull a squeegee across the surface, stopping before you reach the edge. Lift the squeegee up and look for a large "ridge" of epoxy where the squeegee stopped. The ridge under the top ply indicated that the layup is too wet and you should spend time with the squeegee to remove epoxy off to the sides.

Don't hesitate to use your stippling roller or brush on an area after squeegeeing. But resqueegee afterwards to check epoxy content. Some places are not suited to the use of a squeegee and the dry brush or roller can be used to expel the excess epoxy. On a given layup, about half of your time should be spent squeegeeing.

Step 8: General Inspection

After you have finished the layup, take a few minutes and give it a good general inspection for trapped air, dry glass, excess epoxy and delamination. It is much easier to correct these things while the layup is wet than to repair the cured layup. Also, have someone else inspect it, usually a differnet person can find air flecks or bubbles that are missed by one inspector. Glance the light off the surface at various angles to look for air flecks. If any air is visible, stipple or squeegee it out.

Be sure the overlaps on the edges are perfect. If, due to a sharp corner etc., you have a problem eliminating an air bubble, use one of the following two methods: (1) Lift the cloth up off the foam, trowel some wet micro into the troublesome area, add more epoxy as you stipple the cloth back down. (2) Add excess epoxy over the bubble, cover the surface with Saran wrap (thin plastic wrap) then push firmly outwards to force the air out to the sides. The Saran wrap will seal the surface to keep air from being drawn in. This method will force the cloth to stay down even around a sharp corner.

Step 9: Preliminary Contour Fill

Certain areas, like over the spar and along the trailing edge require a dry micro fill. It is preferred to apply this fill within 2-3 hours of finishing the fiberglass layup. However where the micro filler obscures the structure underneath, like over the spar cap, FAA inspection should be completed before dry micro filling. Areas like the trailing edge where the structure can be inspected from the other side should be filled while the layup is still tacky (within three hours of the layup). If you wait until the layup cures, you will have to sand the fiberglass surface to a dull finish before applying the micro. So, mix up a "dry" micro mix and trowel it into low areas while the layup is still wet, and save the work of sanding where feasible. On the trailing edge cover the dry micro with peel ply and squeegee the whole thing to contour.

Step 10: Cleanup

We generally use a cheap brush (approximately $2.00 to $4.00 per dozen) and discard them after use. Clean squeegees by wiping with a paper towel then wash the squeegee in soap or Epocleanse and water.

If you use skin barrier cream (Ply #9) the epoxy and cream will wash off easily with soap and water. When you get epoxy on unprotected skin, Epocleanse is used to remove the epoxy. Both of these products are available through Defiant distributors and are listed in the bill of materials. Once you are sure your skin is clean, wash again thoroughly with soap and water, even if your hands were protected with plastic gloves. If you get epoxy on tools or metal parts, clean them with a clean paper towel then wash them in Epocleanse or soap and water.

The only good way to protect your clothing is not to get epoxy on anything that you care for. Use a shop apron and don't make layups in good clothing. A surplus flight suit or other cheap coveralls are a good investment.

You may feel that layups are real messy work after your first experience with them. However, after you've done several, you will have learned not to scratch your ears, eyes, etc. during the layup. If your tools and work area are clean and organized well and you are disciplined with the epoxy, the job can be a lot less messy than working with other materials.

Step 11: Knife Trim

When a layup is wet, you can only scissor trim to within 1/4 inch without disrupting the fibers in the ply. An easy clean trim can be obtained by waiting three to five hours after the layup. At this time, the laminate is firm enough to support the cloth from fraying, yet soft enough to cut easily with a sharp knife. This "knife trim" stage is the optimum time for edge trimming with ease and accuracy. Take a sharp, single-edge razor blade or X-Acto knife and trim the edges with a motion down ward toward the edge. Experience will help you determine the correct time in the curing cycle for optimum knife trimming.

In the plans when "knife trim" is called for, this assumes the three or four hour wait, even though not specifically stated. Don't fall apart if you miss the knife trim stage and have to trim the fully cured glass. If you wait until the layup is completely set, then saw along the edge with a coping saw, or dremel, bandsaw, saber saw etc. Smooth the edge with 36 grit sandpaper. When trimming a cured edge, be careful of the "needles" (sharp protrusions of glass-frayed edges supported with epoxy). The needles can be avoided by returning three hours after the layup to make the knife trim. Knife trim time varies with temperature: about 6 hours at 70 degrees and 1 hour at 90 degrees. A little heat applied with a hair dryer will allow knife trim if you arrive a little late. CAUTION: hair dryer heat can damage foam cores.

Other Surfaces

Surface preparation (Step 3 of the basic glass layup) varies with the material that you are laying up over. The layup over foam was covered in detail in Step 3. To prepare a cured glass surface for layup, the cured surface must be sanded to a completely dull finish with 36 to 60 grit sand paper. If any of the glossy surface remains, an incomplete bond results which is weak. Better yet, use peel ply as described later. Micro slurry should not be applied to glass surfaces being bonded, this weakens the joint. Wood requires no special preparation for bonding but should be free of grease, oil, paints and varnish. Sand wood surfaces with 36-grit sandpaper before layup. Metal bonding is not relied upon for strength but metal surfaces should always be free of oil and grease. Except for bolts, nuts and other fasteners, metal surfaces should be dulled by sanding with 220-grit sand paper and coated with epoxy before setting in place. Cured micro surfaces should be sanded dull but be careful not to obliterate surrounding foam surfaces while doing it. In practice you may be glassing over several types of material in the same layup and you will be using most of these surface preparation techniques together.

QUALITY CONTROL CRITERIA

One of the unique features of the glass-foam-glass composite construction technique is your ability to visually inspect the structure from the outside. The transparency of the glass/epoxy material enables you to see all the way through the skins an even through the spar caps. Defects in the layup take four basic forms: resin lean areas, delaminations, wrinkles or bumps in the fibers and damage due to sanding structure away in finishing. Resin lean areas are white in appearance due to incomplete wetting of the glass cloth with epoxy during the layup.

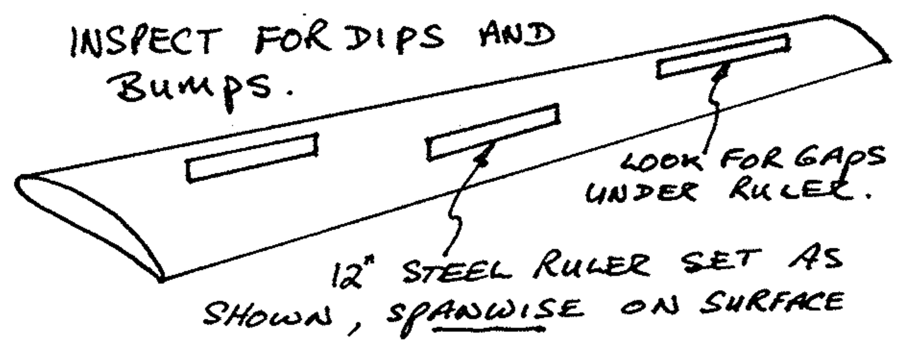
Dryness Criteria - Pick any 6" x 6" square in the layup in the critical area. Assess carefully if any evidence of air in the layup is present (white flecks, bubbles, air at the foam face). If the dryness evidence is more than 10 % of the area, the part MUST be rejected. Reject or repair any evidence of dryness or voids in the trailing edge or leading edge overlaps. Better yet, do an adequate inspection with a good light before cure when it's easy to fix. If in doubt on overlaps be sure to stipple in enough epoxy.

Delaminations in a new layup may be due to small air bubbles trapped between plies during the layup. The areas look like air bubbles and are distinctly visible even deep in a cured layup. Small delaminations, or bubbles up to 2-inch diameter, may be filled with epoxy by drilling a small hole into both ends of the bubble and filling the void with epoxy.

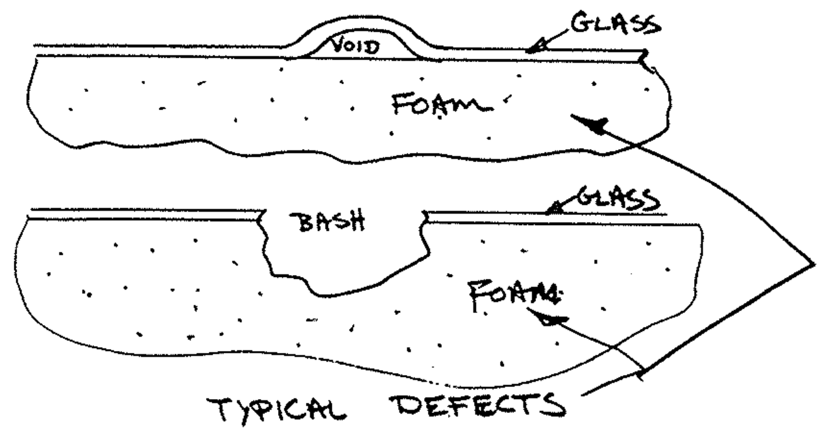
When making a layup, do not be concerned if the brush occasionally sheds a few bristles - these do not need to be removed. If the bristle count exceeds about 20 per square foot, change your brush and remove bristles.

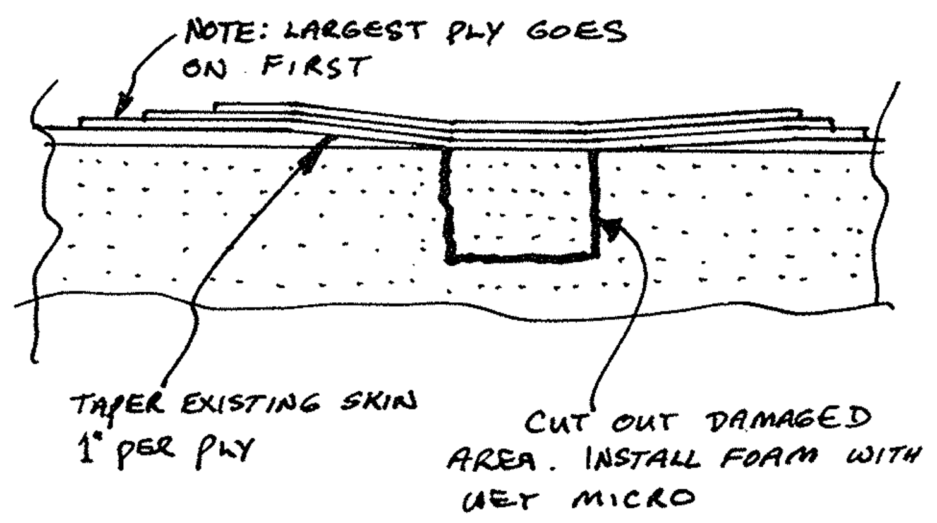
Occasionally sanding through the first weave on multiple ply layups is not cause for rejection of the part. If the sanded through area is less than the size of a quarter it may be left as is, but areas larger than a quarter must be repaired by putting back the ply with a 1 inch overlap. An excess of resin (wet) will make your airplane heavy and does weaken the layup, but usually not enough to reject the part for strength reasons.

Bump/Joggle/Dip Criteria - The best way to check this is to lay a 12 inch straight edge on the part spanwise. Move it all over the surface in the critical areas. If you can see 1/16" gap in any area, the part must be repaired. It is best to repair or beef upn lumpy areas even if they meet this criteria. Better yet, do a good job in core preparation and use your squeegee well in the layup to avoid the lumps in the first place.


INSPECT FOR DIPS AND BUMPS.
LOOK FOR GAPS UNDER RULER.
12" STEEL RULER SET AS SHOWN, SPANWISE ON SURFACE

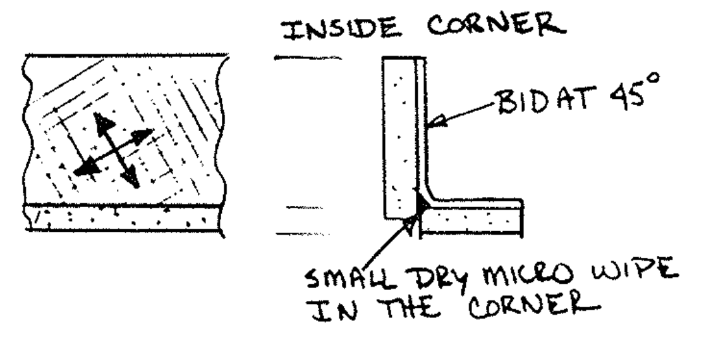
Major wrinkles or bumps along more than 2" of chord are cause for rejection in the wings, canard and winglets, particularly on the top (compression side). This does not mean you have to reject the whole wing - anything can be repaired by following the basic rule: remove the rejected or damaged area and fair back the area at a slope of 1 " per ply with a sanding block in all directions. By watching the grain you will be able to count the plies while sanding. Be sure the surface is completely dull and layup the same plies as you removed. This will restore full strength to the removed area. Use this method to repair any area damaged for any reason - inadvertent sanding through plies during finishing, taxiing a wing into a hanger, etc.




NOTE: LARGEST PLY GOES ON FIRST
TAPER EXISTING SKIN 1" PER PLY
CUT OUT DAMAGED AREA. INSTALL FOAM WITH WET MICRO

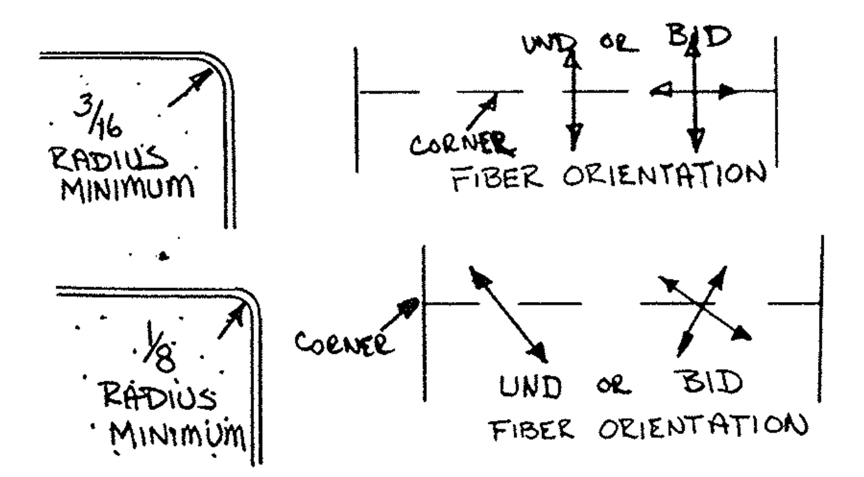
Corner Treatments

A variety of structural corners are employed in the construction of your Defiant. There are two basic types of corners: one where the glass fibers are continuous around the corner and the other where a structural filler is used and glass is bonded to the filler. The corner with the glass fibers running completely around it is used where maximum strength is required.

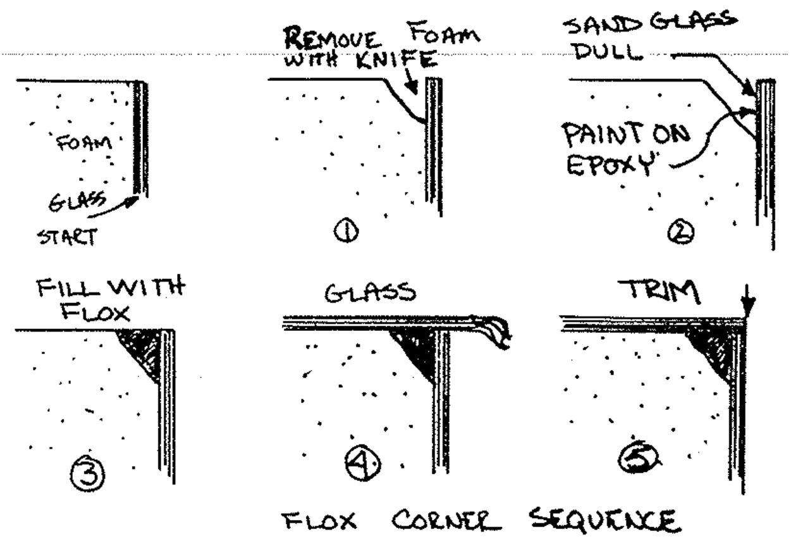


Inside corners can be laid up quite abruptly and only a very slight wipe of dry micro is needed to get the glass to lay into it. When applying micro into an inside corner use a finger wipe or regrind a stirring stick to a 1/8" radius. This is used when putting the bulkheads into the fuselage.

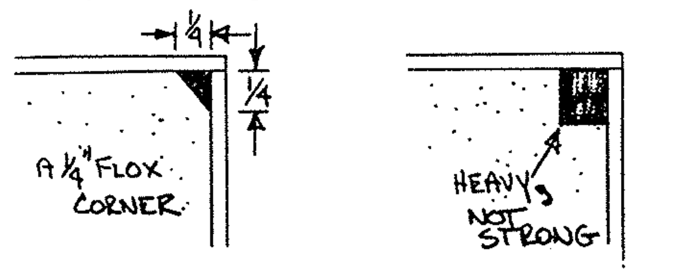
Outside corners require a radiused edge. Where the glass fibers run directly around the corner a minumum radius of 3/16" is required. Where the fibers run at an angle to the radius, only a 1/8" radius is needed.



In some areas a sharp corner is desirable and maximum strength is not required. In these areas a flox corner is used. A simple unsupported glass corner has very poor strength. To strengthen this corner a triangle of flox is used to bond the glass plies together. The flox corner is done just before one glass surface is applied for a wet bond to one surface. The other glass surface has to be sanded dull in preparation as shown.



If a specific size of flox corner is desirable, an approximate dimension may be given as shown. Don't make your flox corners square. The extra flox only adds weight, not strength.

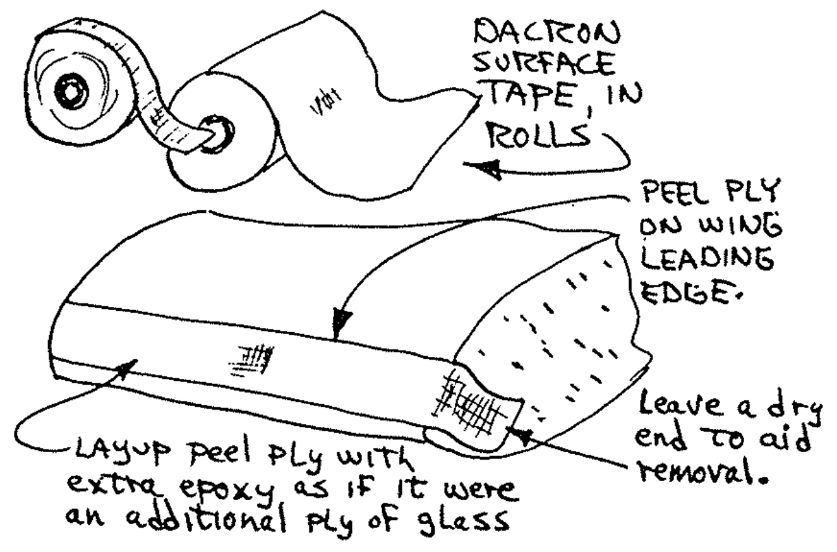


PEEL PLY

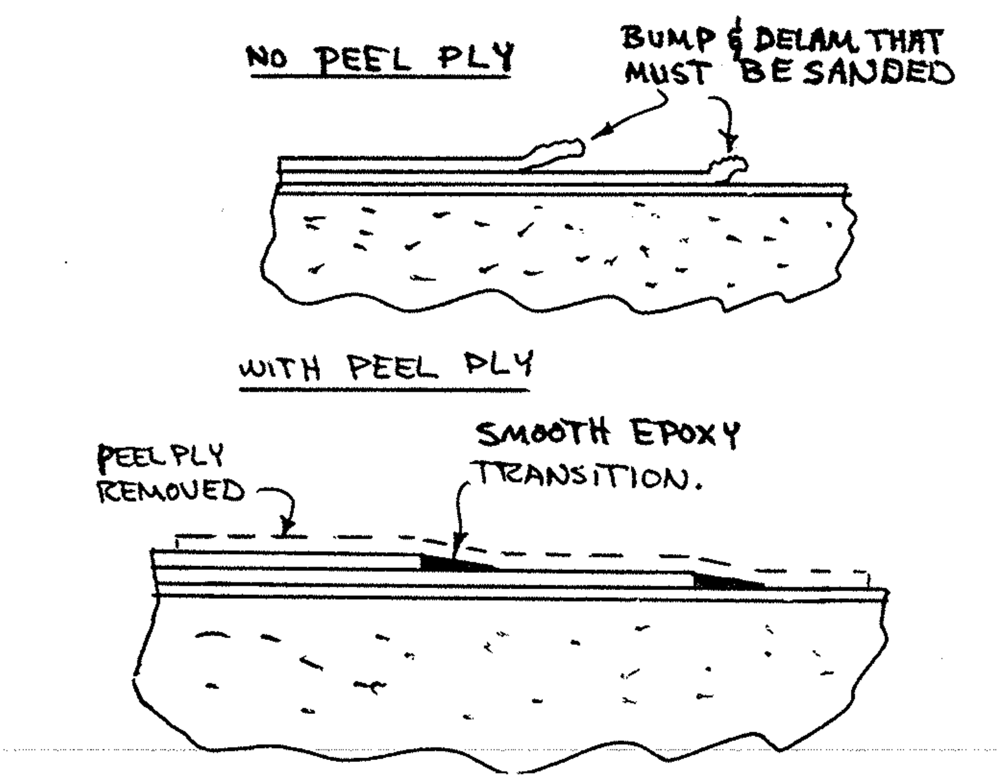
Peel ply is a layer of 2.7 oz. dacron fabric which is layed up over a fiberglass layup while the fiberglass is still wet and is later removed by lifting an edge and "peeling" it off. The most convenient form of dacron to use is "surface tapes", normally used in covering fabric aircraft. These are available in rolls. You will need several rolls, 1", 2" and 4" wide. Peel ply is used for two purposes: (1) Peel ply any area that will later be structurally attached to another fiberglass layup. Once the dacron is peeled off, the surface is ready for another layup without sanding. If you do not use peel ply you will have to sand the surface completely dull (no shiny spots). This sanding is hard, itchy work and ruins the strength of the outer ply of fiberglass.

So remember to peel ply the following areas. Main wing spar caps, canard leading edge and shear web. The edges of all the bulkheads and all places where a future layup will join to an existing layup. Peel ply is needed at the trailing edge of control surfaces and wing outboard panels when the trailing edge comes to a point. In this application it is put under the layup on the foam. (See the section on trailing edge treatment).

The thing to remember is that peel ply is never left in the finished product either between or under layups. Peel ply on foam is only used when that foam will be removed later and glass to glass bonding will take place. If you are about to put peel ply in a place where you cannot get to it later or do not understand why it should be in the middle of your part, read ahead in the plans, find out when it will be removed. If it is not possible to remove it later, you have probably misunderstood the plans. Another thing to remember is that peel ply adds weight. It fills the weave 100% with epoxy so it should only be used where it will serve its purpose of bonding or transitioning plies. Do not get carried away and peel ply any more than necessary.


DACRON SURFACE TAPE, IN ROLLS
PEEL PLY ON WING LEADING EDGE.
Leave a dry end to aid removal.
LAYUP Peel Ply with extra epoxy as if it were an additional Ply of glass

(2) The second use for peel ply is to transition the area where the top ply of a layup terminates on the fiberglass surface. These are found at the wing to outboard wing panel junction, canard spar cap plies and on all corner tapes inside the fuselage. Refer to the adjacent sketches. If the top ply edge is laid up bare it results in a rough edge that can delaminate if a little dry. Sanding the rough edge is hard, itchy work and usually results in damaging the adjacent surface. If the edge is over laid with a strip of dacron during the layup (lay on the dacron and wet out by stippling or squeegeeing) it will make the edge lay down flat and will form a wedge of epoxy to smoothly transition the edge. After cure, peel off the dacron. The result is a beautifully transitioned smooth edge with no delamination tendency. Use this method in all places where a cloth edge terminates on the surfaces.



HEALTH PROTECTION

Anyone working with epoxy needs to become aware of the fact that it is possible to develop an allergic reaction to the material. Safe-T-Poxy has been developed especially for hand layups by non-professionals. This epoxy has the lowest tendency towards allergic reactions of any that we are aware of. Sensitivity can come from two areas.

Contact with the epoxy and breathing the fumes. To avoid contact wear Butyl rubber gloves with cotton liners or use Ply-9 hand cream protectant. After a layup wash up with soap and water and apply a hand cream with lanolin. If you are using Ply-9 wash your hands and reapply the cream a couple of times during a long layup. To avoid problems with breathing the fumes, have some ventilation in the work area where you are doing the layup. A small fan will usually do an adequate job of moving air in or out. When you are finished with the layup but still need heat for the cure, shut off the fan as you leave. Becoming sensitized to epoxy is usually a progressively worsening situation with small and smaller exposures necessary to cause a reaction. The number of people that have developed a reaction to Safe-T-Poxy is small and often the reaction is not to the epoxy but the Ply-9 or the gloves or people using M.E.K. or lacquer thinner to clean brushes. If you thin epoxy by cleaning brushes in MEK, that combination will go through the skin into the body more easily than the thick epoxy by itself. Keep MEK, lacquer thinner or toluene out of your shop, it will increase your chances of an epoxy reaction. The common reactions to epoxy systems are breaking out on the hands, arms or face, a rash in the same areas or swelling in the same areas. We have taken the space to reprint a study that was done by the epoxy manufacturer to inform you of the possibility of reaction not the likelihood.

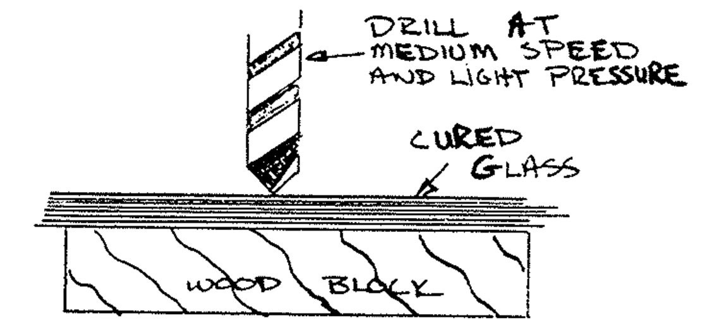
Use good work habits and you will probably avoid any reaction.

Dust Protection

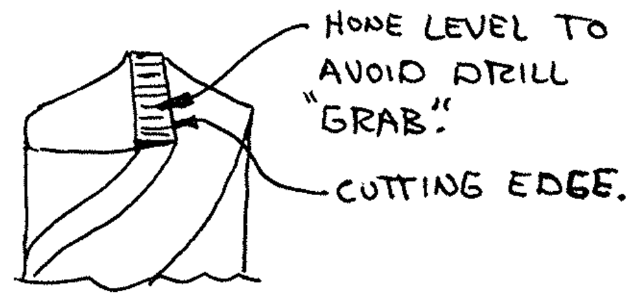
Sanding or grinding fiberglass and foam creates dust that can be harmful to your lungs. Use a dust respirator mask for their operations. Disposable dust masks are available at most paint stores.

DRILLING, GRINDING AND SAWING

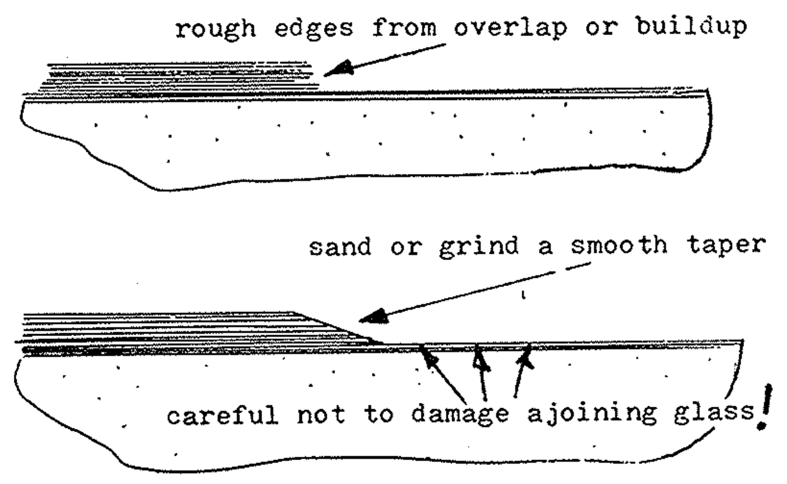
Drilling through cured glass tends to tear the surface plies on the back side. Backup a glass layup with a wood block for drilling as shown and drill at medium speed.



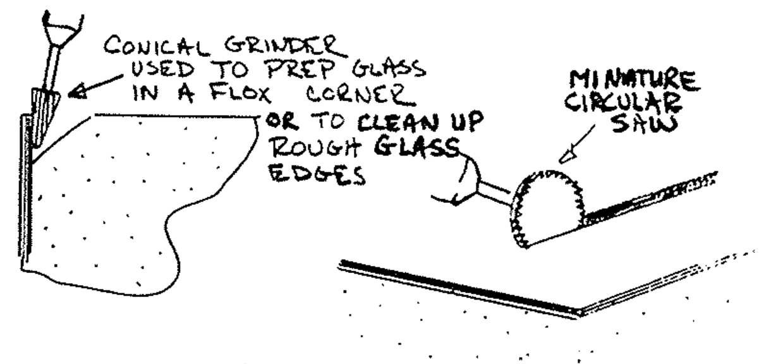
Using a small hone, grind the cutting edges of your drill bit flat as shown (not undercut). This will keep the drill from grabbing into the glass. Don't over do it, just make a couple of light passes with the hone.

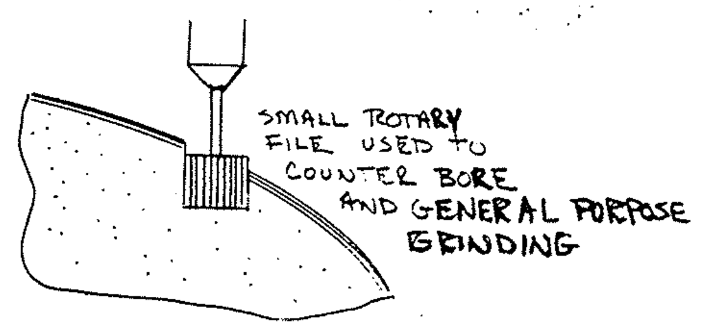


In several places rough cured glass surfaces occur where overlaps or thick buildups are done. These rough edges should be smoothed as shown using a grinder or sanding block.


rough edges from overlap or buildup
sand or grind a smooth taper
careful not to damage ajoining glass!

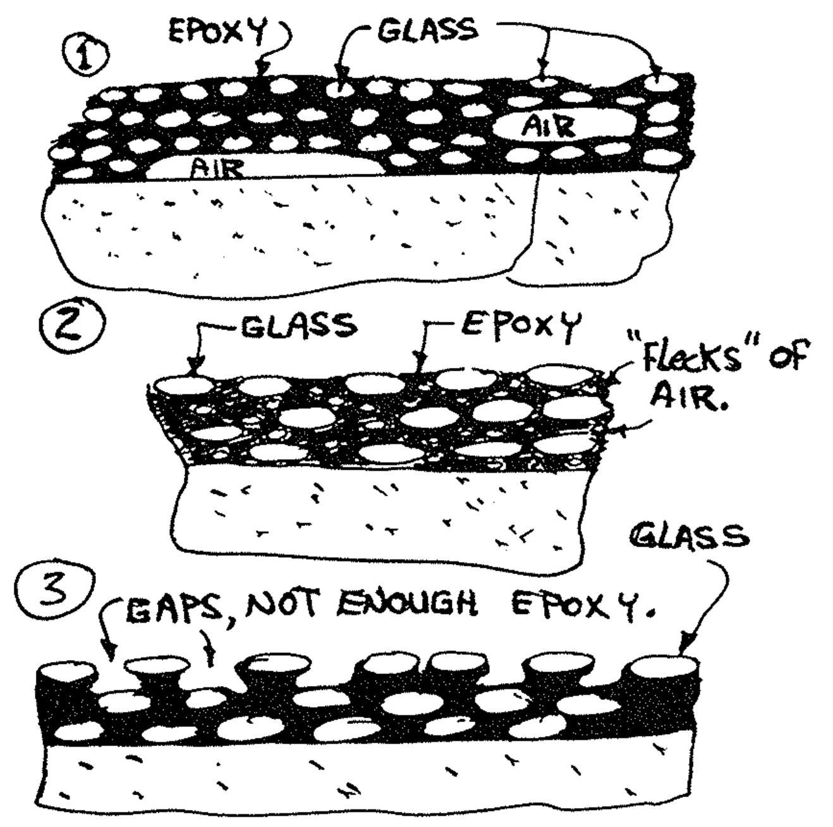
The Dremel (Moto Tool) or Home Shop (Weller) is a very versatile tool with many uses in the construction of your Defiant. The kits usually have a nice selection of bits, cuts, grinders, stones and mandrels for every conceivable use. Several types that are not in the kit are very useful. Dremel makes a 1/8" carbide bit with a round end, this is very good for cutting holes in glass sandwich panels. Merrit Abrasives makes 1.5" disc sander heads that will fit the Dremel with snap lock discs. The coarse discs will do an excellent job sanding cured fiberglass. Don't throw the others out, your buddy next door might be able to use them on his radio controlled golfball project.


CONICAL GRINDER USED TO PREP GLASS IN A FLOX CORNER OR TO CLEAN UP ROUGH GLASS EDGES
MINIATURE CIRCULAR SAW


SMALL ROTARY FILE USED TO COUNTER BORE AND GENERAL PURPOSE GRINDING

RECOGNITION OF A DRY LAYUP

One of the most important things you must know is how to inspect for the presence of air within a layup. Air leaves somewhat crystal-like flecks of white areas, noticeably different than the white color of the microballons. The presence of air is shown in the adjacent sketches in 3 forms: (1) A bubble or large void at the foam surface or within the laminate, (2) small bubbles of air scattered throughout an area, or (3) inadequate filling of the outer ply. Make a layup of 3 ply BID in a 6" square over a scrap piece of foam, trying to achieve these 3 types of dryness. Let it cure with the defects. This will be a handy sample to use to instruct others who will help you inspect.



SPAR CAP 'S' GLASS ROVING

Refer to Page D-58 for full scale details of the parts necessary to build your own roving wetting machine. This should be built early in your building sequence since you will be needing to wet out 'S' glass roving for your centersection spar. You will want to pull at least four rovings through the wetting machine at a time. These rovings will be guided into the machine and routed over the top of the aluminum "wheel" that rotates in the epoxy bath. The epoxy that is picked up by the "wheel" is "cut" off by the doctor blade to a given film thickness. Our experience has shown that this film thickness varies from approximately .009" to .011". This should be determined by trial and error to give you the optimum wet out of the strands of 'S' glass roving. The optimum wet out is when the spar cap you are laying up requires little or no additional epoxy to be thoroughly wetted out. Set the doctor blade at approximately .010 (ten thousandths of one inch) using a feeler gauge. This is a good starting point. Pull some roving through the machine. The roving will pick up epoxy from the top of the wheel. Initially it will not look wet enough. Cut it to the length required and lay it into the prepared spar trough. (Paint a thin coat of epoxy inside the spar trough before laying in the roving). Pull it straight and squeegee it using a small plastic squeegee cut from a coffee can lid. Pull more lengths and lay them into the trough until there is approximately 1/16" of total glass thickness full width of the trough. Now use your plastic squeegee to thoroughly squeegee the spar cap. It should wet out uniformly and should look smooth, with no dry spots. If there are dry spots you can introduce a little epoxy with a brush locally to these areas. Use a hair dryer and your squeegee to get the spar cap uniform and nicely wetted out. Lay in about 1/16" increments between squeegeeing until the trough is filled at the ends. Now start trimming the roving shorter and shorter until the whole trough is filled. Squeegee thoroughly at each 1/16" thickness increase. Trim the roving at about a 60° angle with sharp scissors rather than cutting it at 90°, to make a better transition.

If your spar cap material was too dry, open the gap between the aluminum wheel and the doctor blade a thousandth or two to .011 or .012. Try again. If your spar cap is too wet, and you are squeegeeing an excessive amount of epoxy off the ends, (you should always squeegee from the center out to each end), you will need to adjust the doctor blade gap to perhaps .009 or even .008. The correct film thickness will give the roving just the right amount of epoxy so that when it is layed in a spar trough and squeegeed, it will wet out exactly right and should have an appearance just like that on a BID or UND layup.

Refer to Page C-3 for photos of Fred's roving wetting machine. The one called out in these plans is not identical to Fred's or to the one we use here at RAF, but is a very adequate machine.

GENERAL HINTS

You can generally tell the quality of workmanship just by looking at his shop. Clean up and sweep up after every step. Keep your tools organized and clean. Dirt in or under a layup will increase weight and decrease strength. A clean shop will reflect on your airplane and will make construction more pleasant. A key to good glass layup is preparation.
Copy the check list below and post in your shop.

BEFORE ANY GLASS LAYUP

1. Tools cleaned and available
   Squeegee Cups
   Brushes Scissors
   Rollers Ply-9 or Gloves
   Sticks

2. Workbench clean
3. Glass cut and rolled
4. Surface to be glassed -
   correct shape and smooth contour, sanded dull and dust blow or vacuumed off
5. Temperature of room and epoxy 70 to 90° F.

Protection of foam during layups

If you get raw foam contaminated with epoxy it will cure and be very difficult to remove without damage to the foam. During a layup where there is raw foam that will not be layed up onto, protect it with gray tape or tape and newspaper. This is the case on the Defiant when laying up the spar cap material into the spar troughs. Cover the bare foam around the spar trough.

ATMOSPHERIC CONDITIONS

Temperature has the greatest effect on the working properties of your epoxies. 77° F. is an ideal temperature. The range from 75° to 95° is acceptable with the precautions mentioned in the section on EPOXY. Humidity has a lesser effect on these materials than it does on aircraft dopes and some paints. Humidity will only create problems if it is over 75%. Don't undertake a layup if it is pouring down rain outside or, if you notice a cloudy "blush" on the wet epoxy surface, or any evidence of whiteness in the epoxy due to moisture.
In high humidity areas keep your cloth in a low humidity environment, ie. in a warm house in the winter or an air conditioned house in the summer. You can build a cabinet for storing the cloth rolls as shown and use a light bulb with a thermostat to raise the temperature of the cloth and thereby lower the humidity.

Heat Deformation and Creep

Several builders have had flying surfaces warp or bend due to being poorly supported until fully cured. Do not hang or support them at each end for long periods as they may "creep" or slowly deform. Store them leading edge down with support in at least three places. Your surfaces can be better protected against "creep" if you post-cure them. Sailplane manufactrueres do this by putting the entire airplane in an oven at 160° F. You can do as follows: after you have painted on the dark grey primer, put the wing/winglet or canard out in the sun. Be sure it is well supported in at least three places along its span. At noon a dark surface can reach 140° to 180° F. giving it a relatively good post-cure. After the post-cure, the structure is more stable for warping or creep.

If you have a wing or canard that is twisted wrong, apply a twisting force in the opposite direction before and during the post-cure (weights applied to boards can be used). Remove the force only after the surface has cooled. A 200 ft/lb torque (50 lb. weight on a 4 ft. arm) applied twice, once while the top surface is post-cured and once for the bottom surface, can twist your canard over one degree. The twist correction will be permanent and will stay as long as the surface remains below the post-cure temperature. This is generally referred to as the heat-deformation characteristic of the epoxy. If it is room temperature cured only, it will soften above 140° F. But if post-cured it will not soften until over 160° F. Heat for post-curing or for intentional deforming can be applied by other means such as heat lamps, hair dryers or electric radiant heaters (household type), however this is generally not recommended, since it is too easy for the homebuilder to get the part too hot and ruin the part. The blue foam is damaged above 240° F. If you want to use these heat sources, do so by applying the heat very slowly and checking the temperture often by placing your hand on the surface. If you can hold your hand on the surface five seconds without pain, the temperature is okay - three seconds is too hot.

A pneumatic riveter is not required to build your Defiant. The few hard rivets used can be set with a hammer, using your vise as backup. The 'pop-type' rivets are pulled with a low-cost hand puller available at any hardware store.

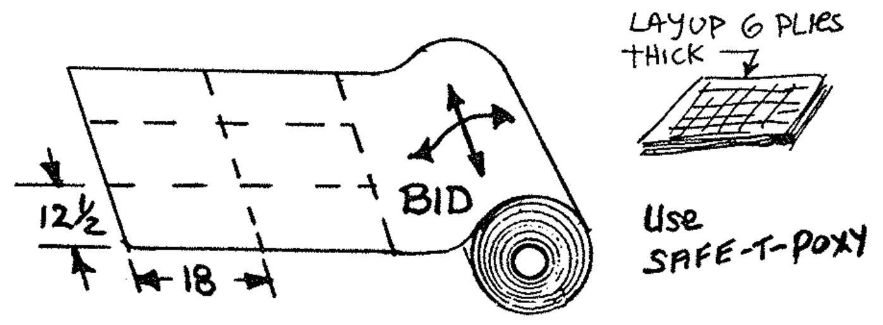
PRACTICE LAYUPS

If you have no previous composite aircraft construction experience, we strongly recommend that you do the following practice layups.

Flat Layup

The first practice layup that you will make is a layup of six BID plies onto a flat surface. This is intended to give you experience in the techniques of glass/epoxy work and to give you a check on your workmanship. You should be able to complete this layup in about half an hour.

Protect your work bench by taping waxed paper over an area about 24" by 24" (or, find a piece of metal and wax its surface). This will keep the epoxy from bonding to the table top. Cut six plies of BID that are about 12 1/2 inches by 18 inches.



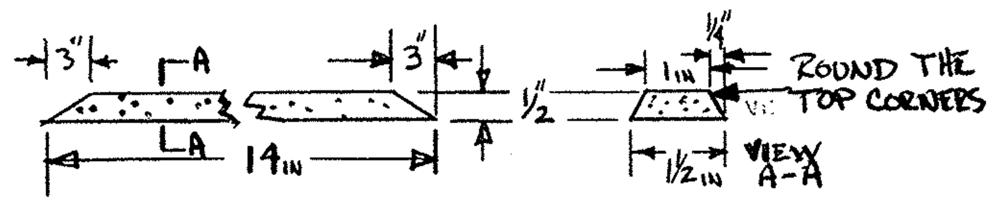
Laminate the six plies on top of the waxed paper. Try to do your best job of stippling and squeegeeing so that the plies are completely wetted but not full of excess epoxy. Let the layup cure to knife trim, about four hours. Carefully mark a 10 inch by 16 inch rectangle and knife trim the layup to that size using a sharp razor blade or trim knife. Allow the layup to cure completely. If you forget the knife trim, cut the cured piece with a coping saw or band saw.

Take the cured 10 inch by 16 inch piece to your post office, or any accurate scale, and ask them to weigh it for you. Your laminate should weigh between 10 1/2 and 12 1/2 ounces. A 10 1/2 ounce layup is about as light as can be done without voids (white areas). A 12 1/2 ounce layup has too much resin, and if you make all of the layups in the airplane this wet, your Defiant may be as much as 60 pounds over weight. An 11 ounce layup is just about perfect. Save this piece, it will be useful material later on.

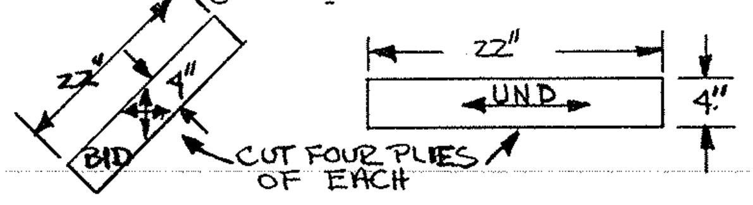
Confidence Layup

The second practice layup is one intended to give you confidence in the strength of your work. This layup is a sample of composite sandwich structure and typical of the load carrying structures in your Defiant. When this layup is finished and completely cured, you will subject it to a simple load test and thus demonstrate the strength of your workmanship.

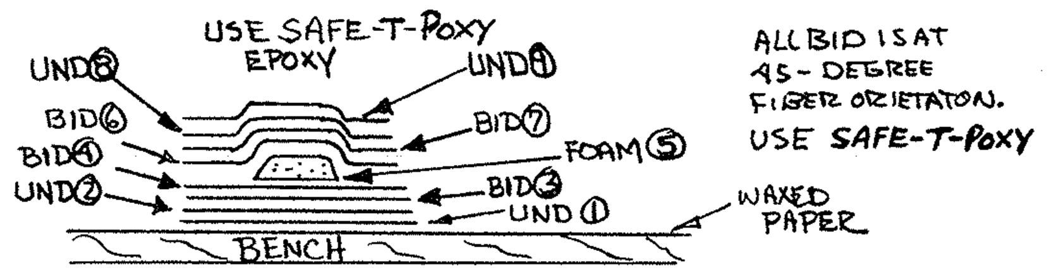
First, tape a piece of waxed paper about 30 inches long to the top of your work table. Shape a piece of urethane foam as shown.



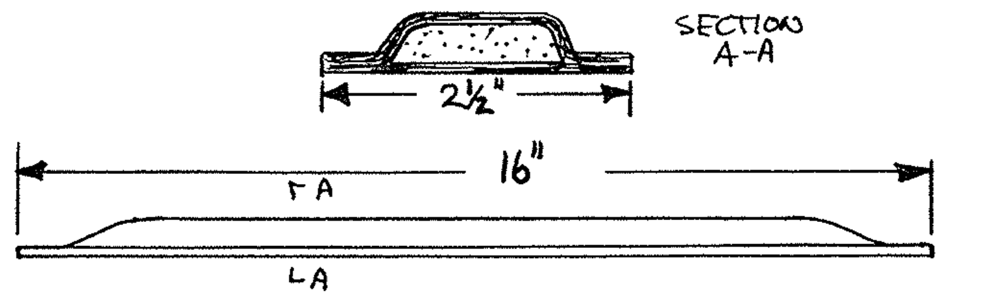
Go to your glass cutting area and cut the glass plies shown.



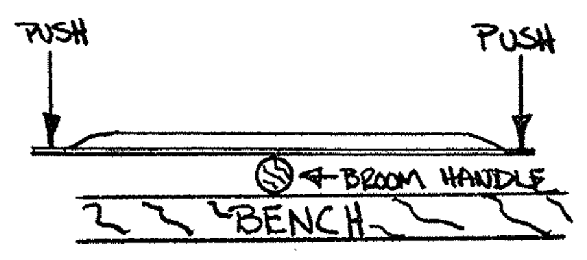
Lay up two plies of UND, two plies of BID, paint the foam with micro slurry and press it in the center. Then lay up the other BID and UND plies.



Be careful to work all air bubbles out of the corners. The best way is to stipple with the brush. The glass is oversized so that it can be trimmed to exact dimensions later. Trim to the dimensions shown after curing 24 hours, using a coping saw or band saw.



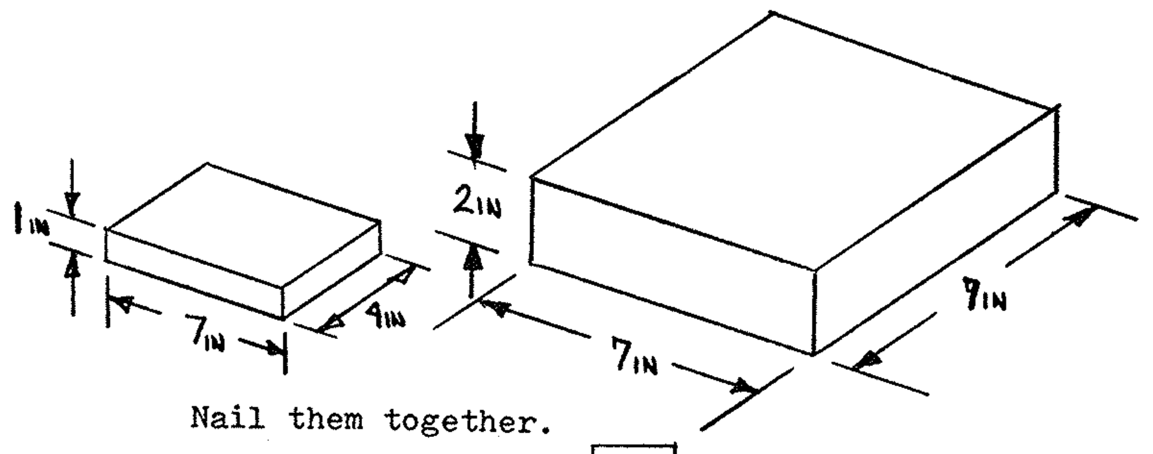
Allow the piece to cure for four days at room temperature before the load test. Now for the test: lay a broom handle or piece of tubing on the work bench and try to break the sample by putting all of your weight on the ends. A 200 pounder will stress the sample more than any part of your airplane is stressed at 10 gs!



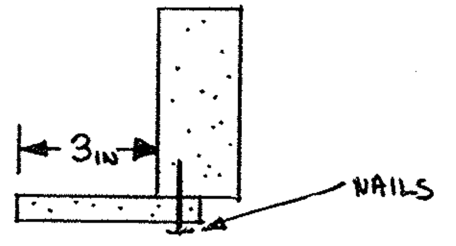
Book End

The last practice part that you will make before starting on your airplane, is a book end. It takes three layups to make the book end and involves most of the operations that you will need to learn to build your airplane.

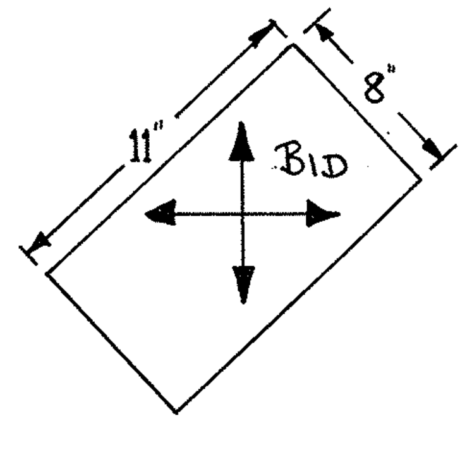
Cut the two blocks of greem urethane foam (2 lb/ft³) as shown.



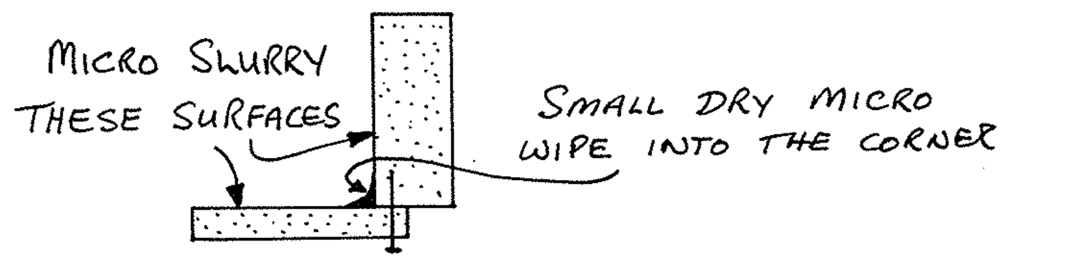
Nail them together.



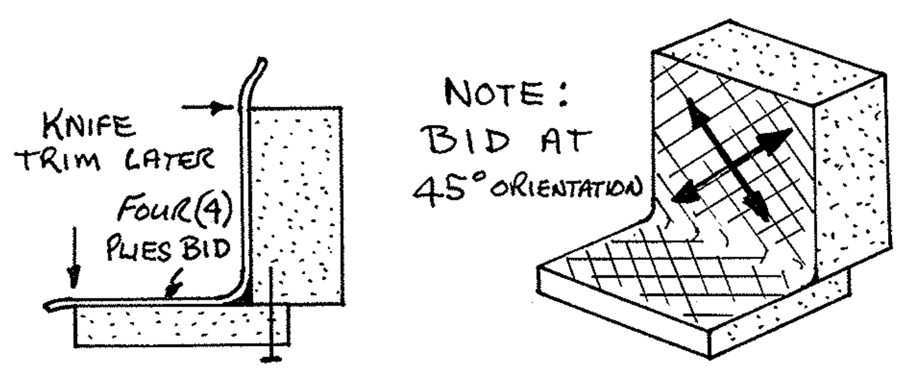
Cut three plies of BID as shown.



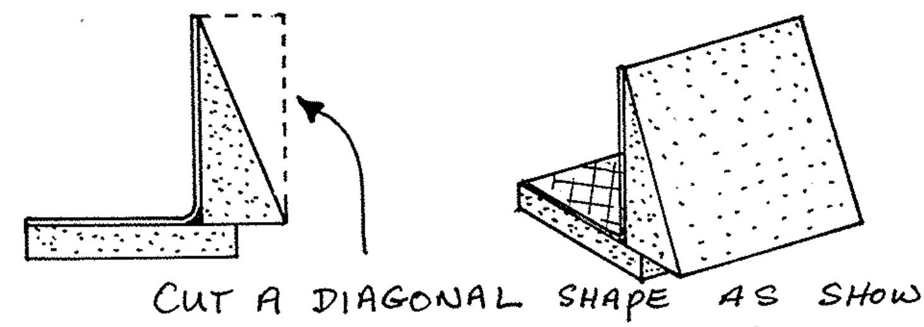
Mix 4 oz of Safe-T-Poxy. Using about 1 oz, make a small batch of micro slurry and coat the foam as shown. Make dry micro from the left over slurry and make a small radius with it as shown.


MICRO SLURRY THESE SURFACES
SMALL DRY MICRO WIPE INTO THE CORNER

Lay up the first ply of BID as shown. Using plain epoxy (no micro), lay up the other two plies and allow to cure. Note how the 45° fiber orientation allows the glass to lay down completely into the small radius.

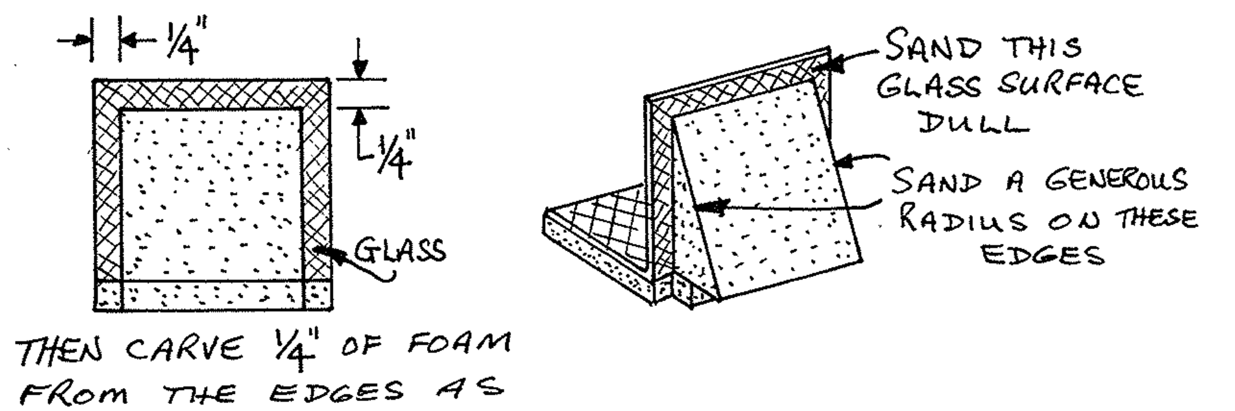


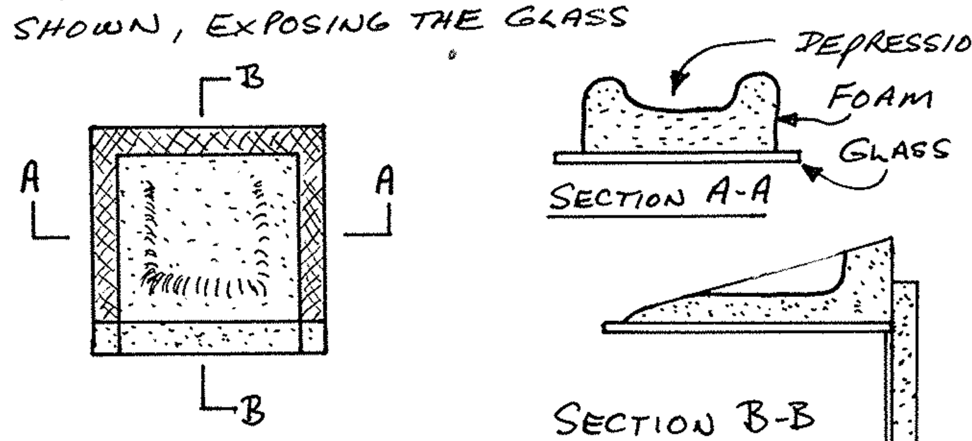
Knife trim along the foam edges. After the first layup has cured and the edges have been trimmed, the thicker foam block is carved and contoured as shown.

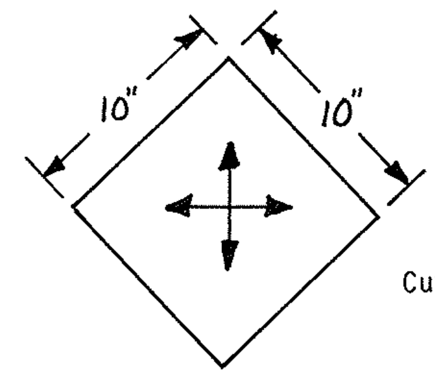


Put a generous radius on the foam edges and sand the 1/4" wide glass edges dull for glass to glass bond. Use your wire brush to rough out a depression in the middle of the block.

Finish smoothing the depression by rubbing it with a scrap of green foam. Radius the corners of the depression. Blow or brush all of the foam dust off the surfaces.

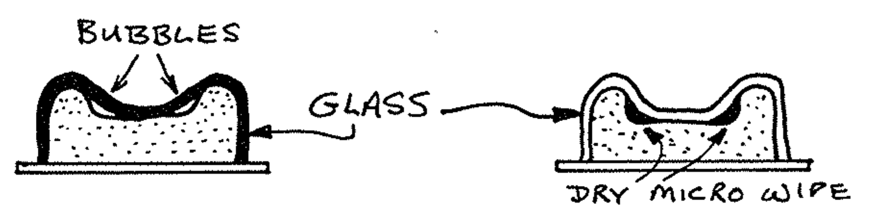

¼"
¼"
GLASS
SAND THIS GLASS SURFACE DULL
SAND A GENEROUS RADIUS ON THESE EDGES
THEN CARVE ¼" OF FOAM FROM THE EDGES AS SHOWN, EXPOSING THE GLASS



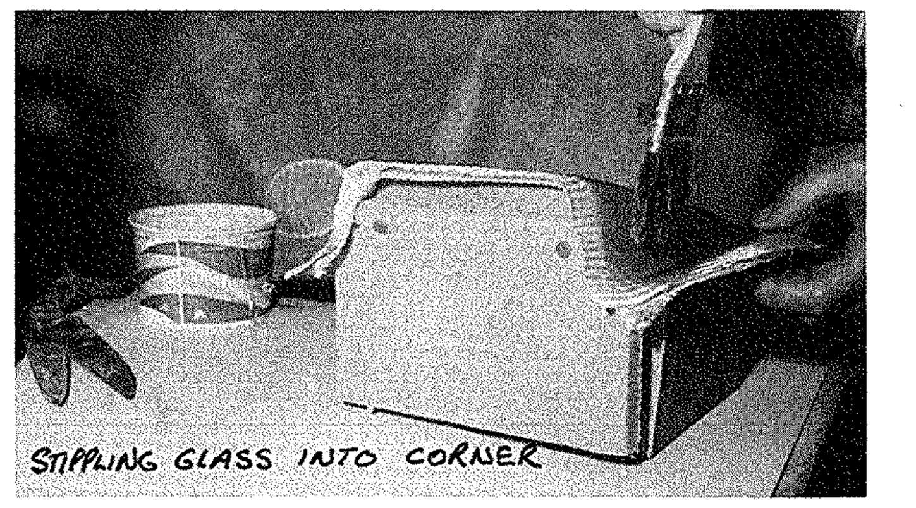


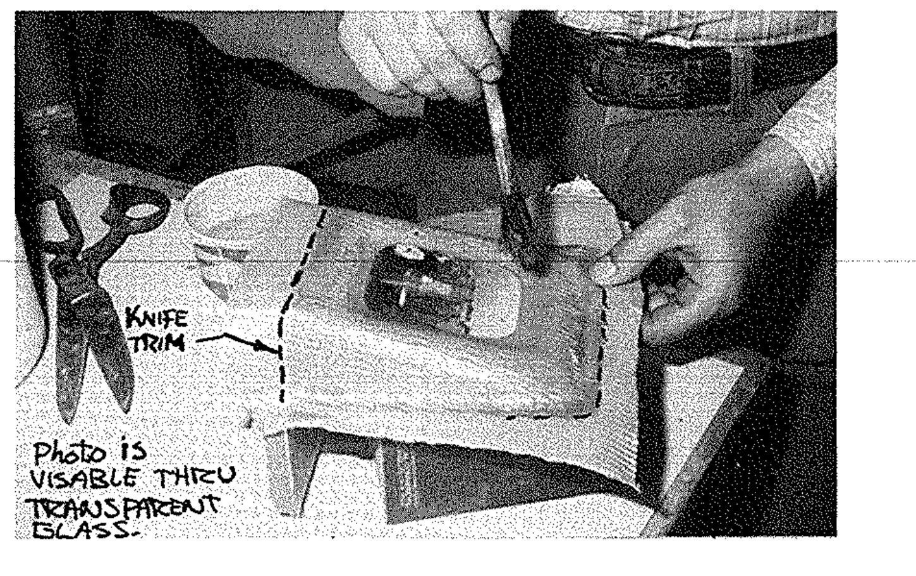
Cut three plies of BID as shown.

Mix Safe-T-Poxy to make a small batch of slurry and save the remaining epoxy. Slurry the foam surface lightly and apply two plies of BID to the contoured surface. Start the layup in the center and work out toward the edges. If you have trouble getting the glass into the depression corners without bubbles, lift the plies and wipe in a little dry micro. You will then find that it will lay smoothly in without voids (see sketch). This depression is sharper than any in your airplane and is intended to give you a feeling of how sharply you can form the cloth.

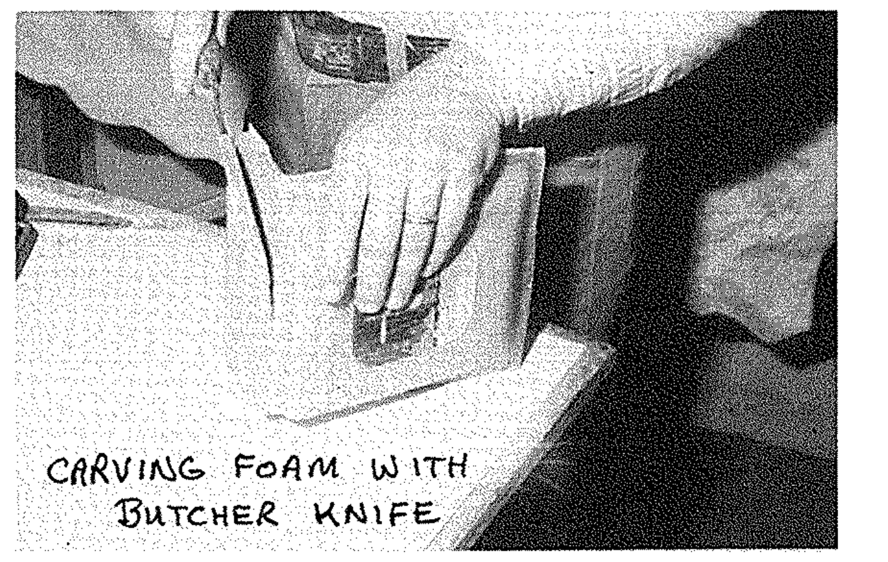


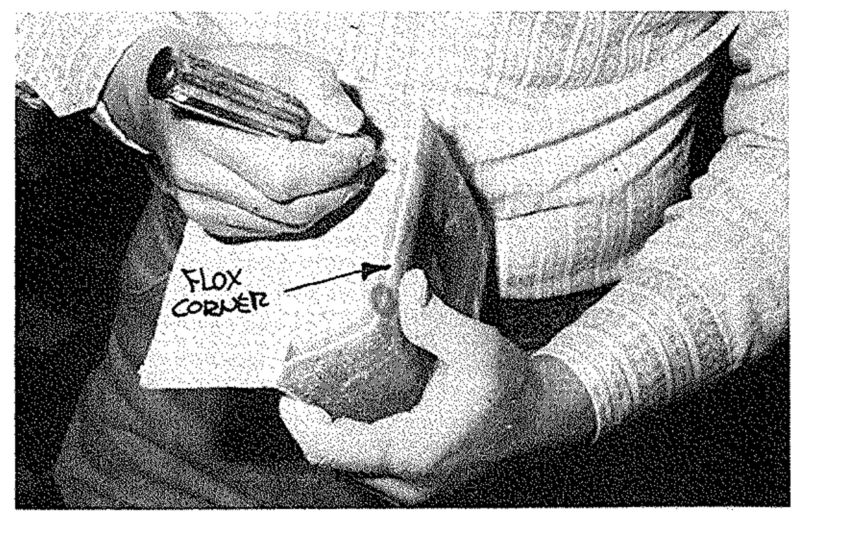
Before laying the third BID ply down, place your favorite photo in the depression, and then lay the third BID ply over it. Scissor trim the excess cloth. Allow to cure and knife trim the edges.

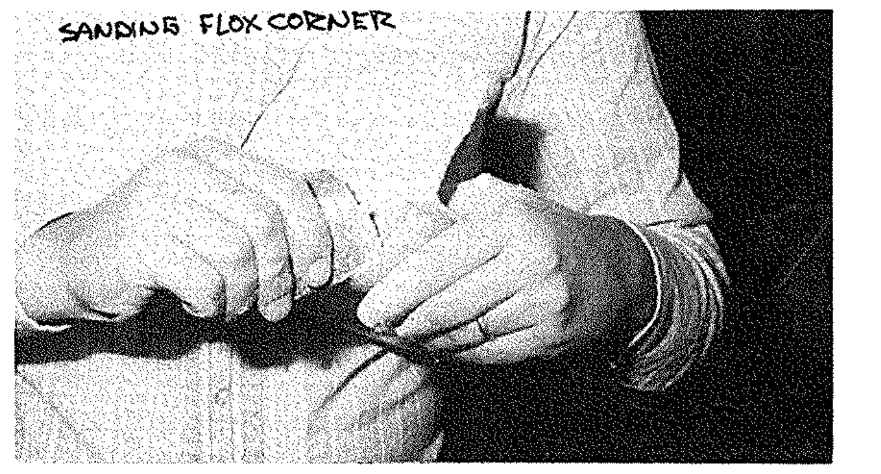

STIPPLING GLASS INTO CORNER

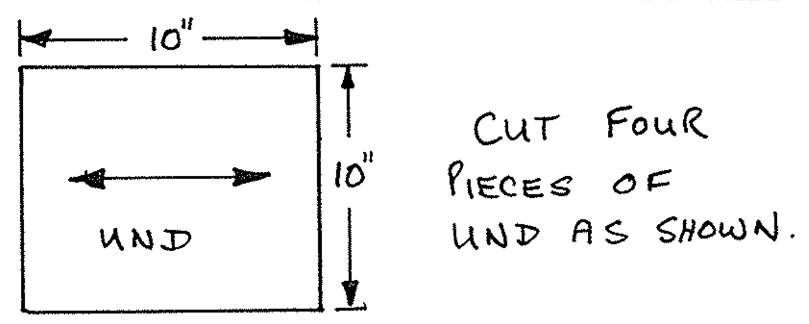


The lower edge is trimmed flush with the bottom of the foam block. Wait until the second layup is fully cured. Remove the 1 inch foam block with a butcher knife and sanding block. Remove foam for a 1/4" flox corner and sand the glass surface dull.

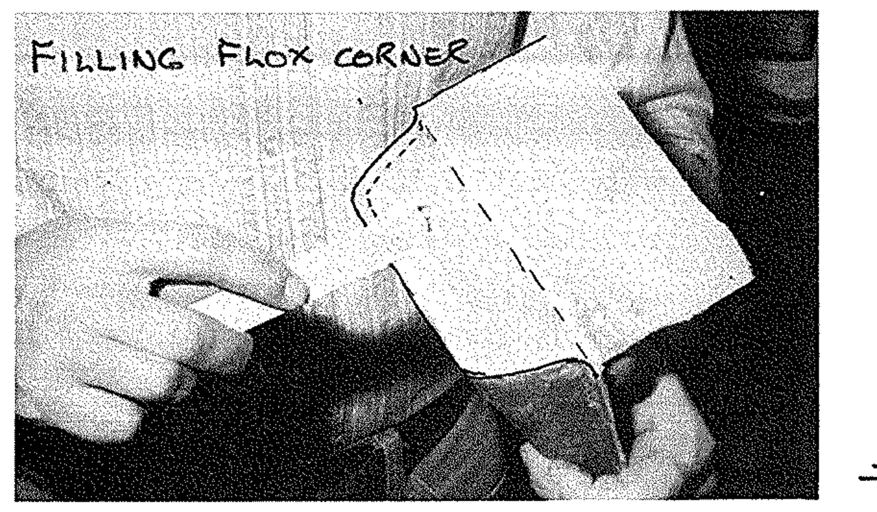

CARVING FOAM WITH BUTCHER KNIFE

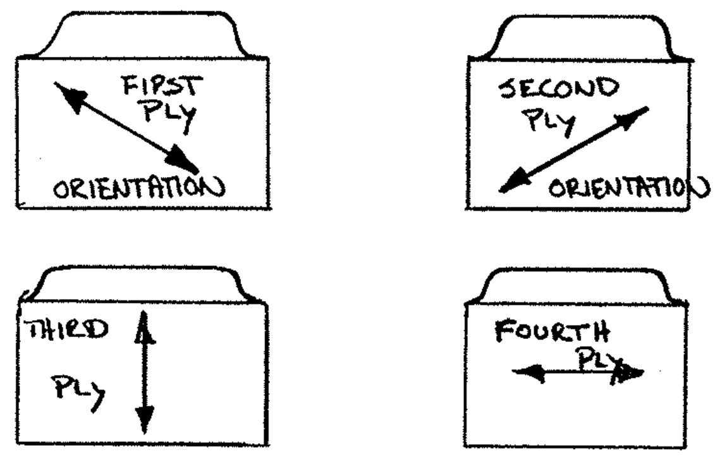


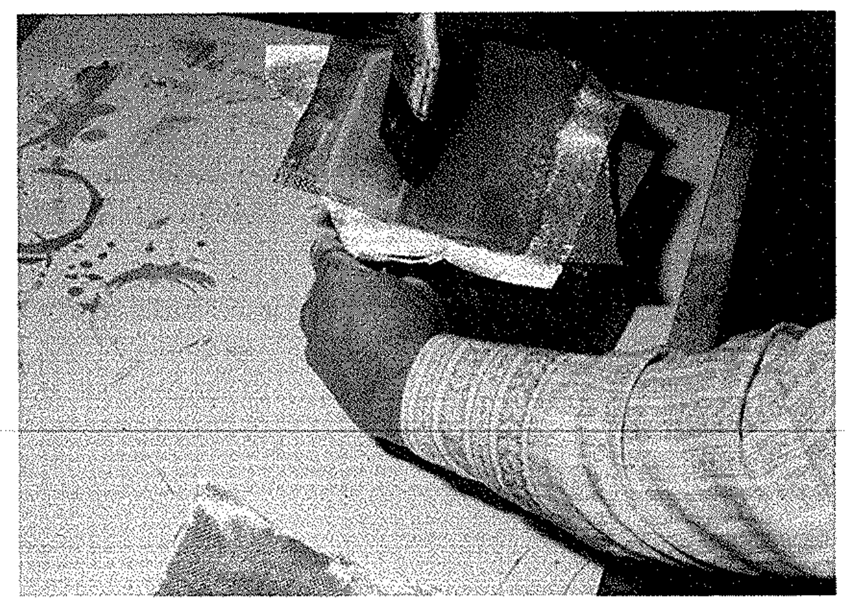

SANDING FLOX CORNER



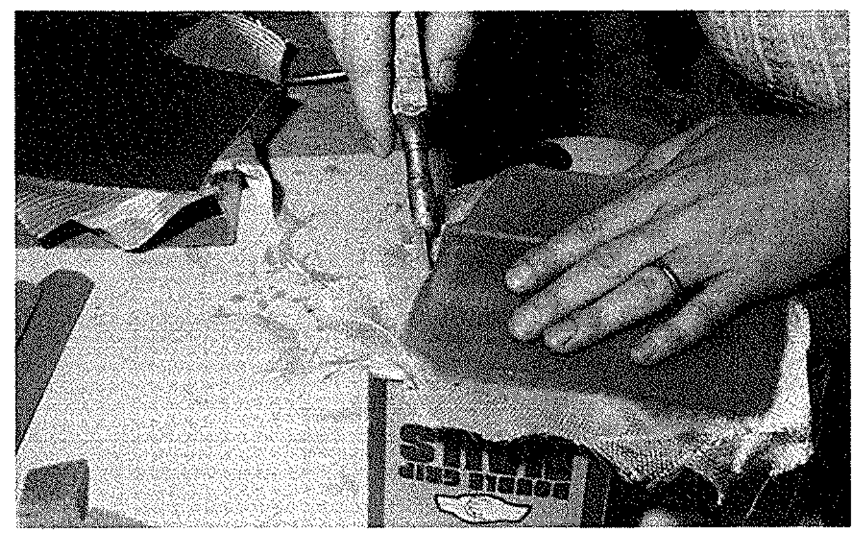
Mix Safe-T-Poxy, a small batch of flox and a small batch of micro slurry. Fill the corner with flox and slurry the foam. Layup the four UND plies with the orientation shown.


FILLING FLOX CORNER

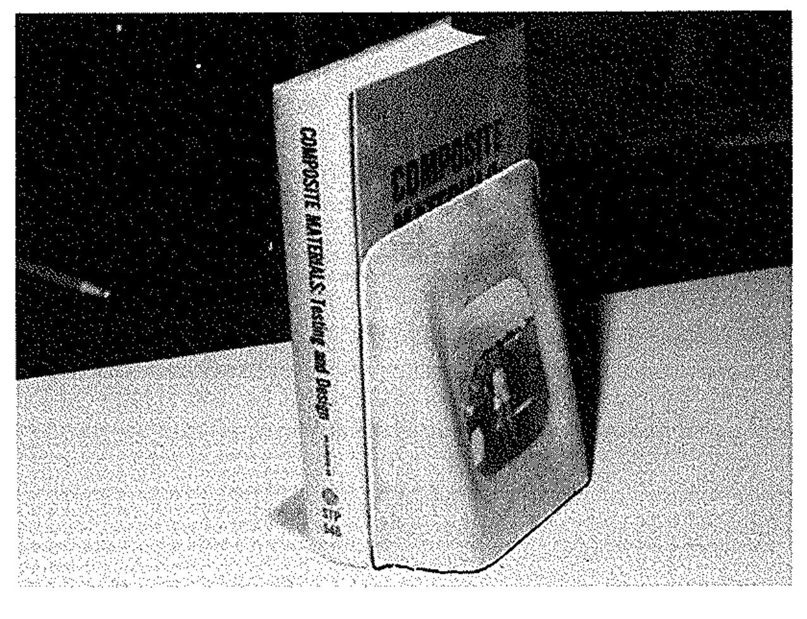




Knife trim the edges. After 12 hour cure, sand the edges with 100 grit sandpaper as required for smoothness and good appearance.



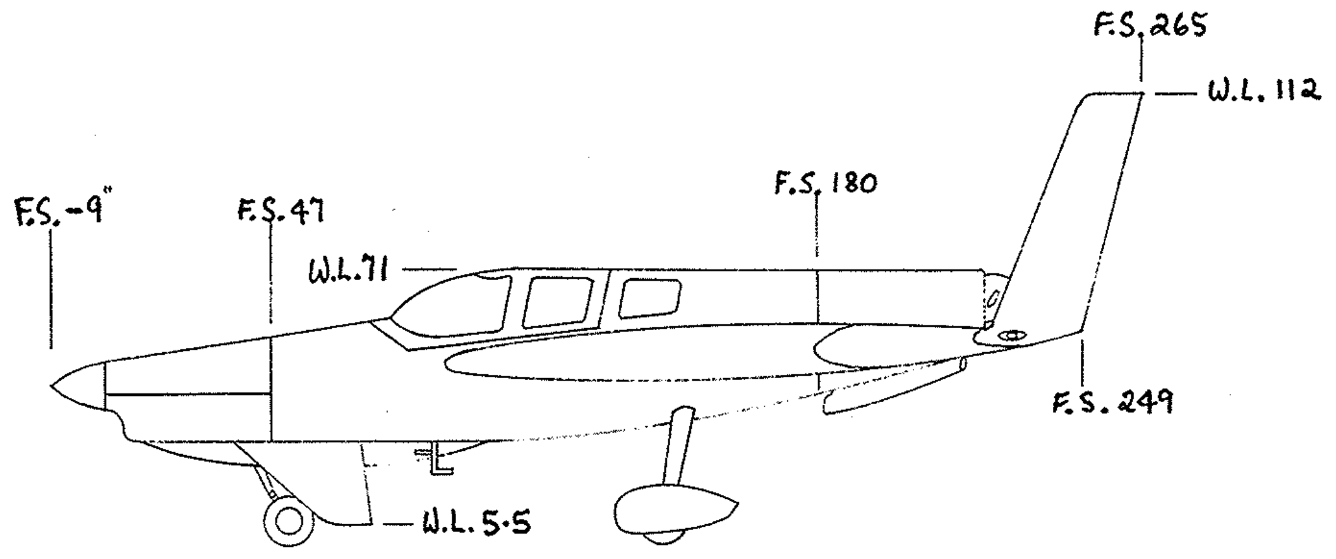
It may at this time seen a bit ridiculous to use three layups, about four hours work and two days cure, just to make a book end! But remember, this book end was not designed for ease of construction: instead, to let you get a first hand exposure to the following operations before starting on your airplane: glass cutting, foam preparation (slurry), BID and UND layups (flat surfaces, corners and compound curves), flox corner, knife trim, concave and convex foam carving, glass to glass surface preparation and sanding edges. So, use this experience to your best benefit and spend the curing time studying the plans. Even if you are experienced in glass layups, the book end is a worthwhile project to get familiar with the workability of this BID and UND weave cloth.



AIRCRAFT MEASUREMENT REFERENCE SYSTEM

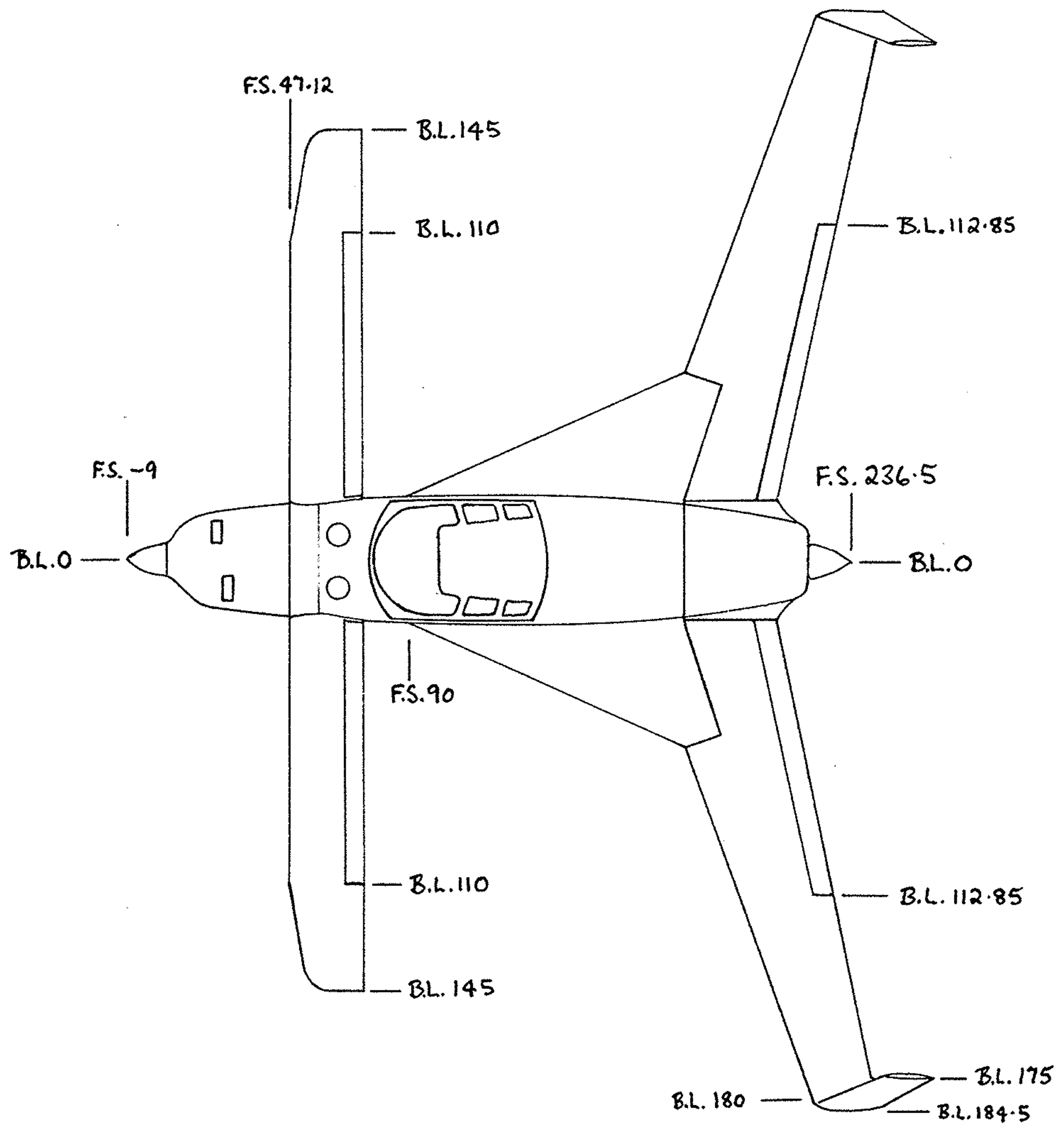
To ease the engineer's task of defining where things go in these odd-shaped gadgets called aircraft, a fairly standard system of references has been developed. Fortunately the Defiant is so simple that an elaborate measurement system is not necessary. It is, however, convenient to use the standard terminology for reference occasionally and you should be familiar with its meaning.

The three basic references are called butt lines, fuselage stations and water lines. Don't blame us for the absurd names, we didn't set the system up. All three are given in inches from some arbitrarily chosen references so, fuselage station 100 is found 100 inches away from fuselage station 0 and similarly for butt lines and waterlines. Being as lazy as anybody else, we abbreviate these as F.S., B.L. and W.L. We use these abbreviations with periods, F.S. not FS, so that they aren't confused with part numbers like CS, which do not use periods. Fuselage stations (F.S.) are used to define the location fore and aft on an airplane. To make things easy, fuselage station 0 is generally located near the nose of an airplane and measurements are made aft. Fuselage stations are the most commonly used of the references and later on you will make a reference mark on your airplane to use as a permanent F.S. reference point.



Waterlines (W.L.) are used to define vertical locations. Waterline 0 is generally found near the ground and measurements are made up from W.L. 0. Waterlines are utilized in many places to position components or templates relative to each other by leveling reference waterlines with a carpenters level.

Butt lines (B.L.) define positions inboard and outboard. Butt line 0 is the vertical centerline of the airplane and measurements are taken to the left and right of B.L. 0. Since left and right depends on which way you are facing, it is standard practice to define left and right as the pilot would, while seated in the cockpit. Using these three references, any point in an airplane can be described with a fuselage station, butt line and waterline.



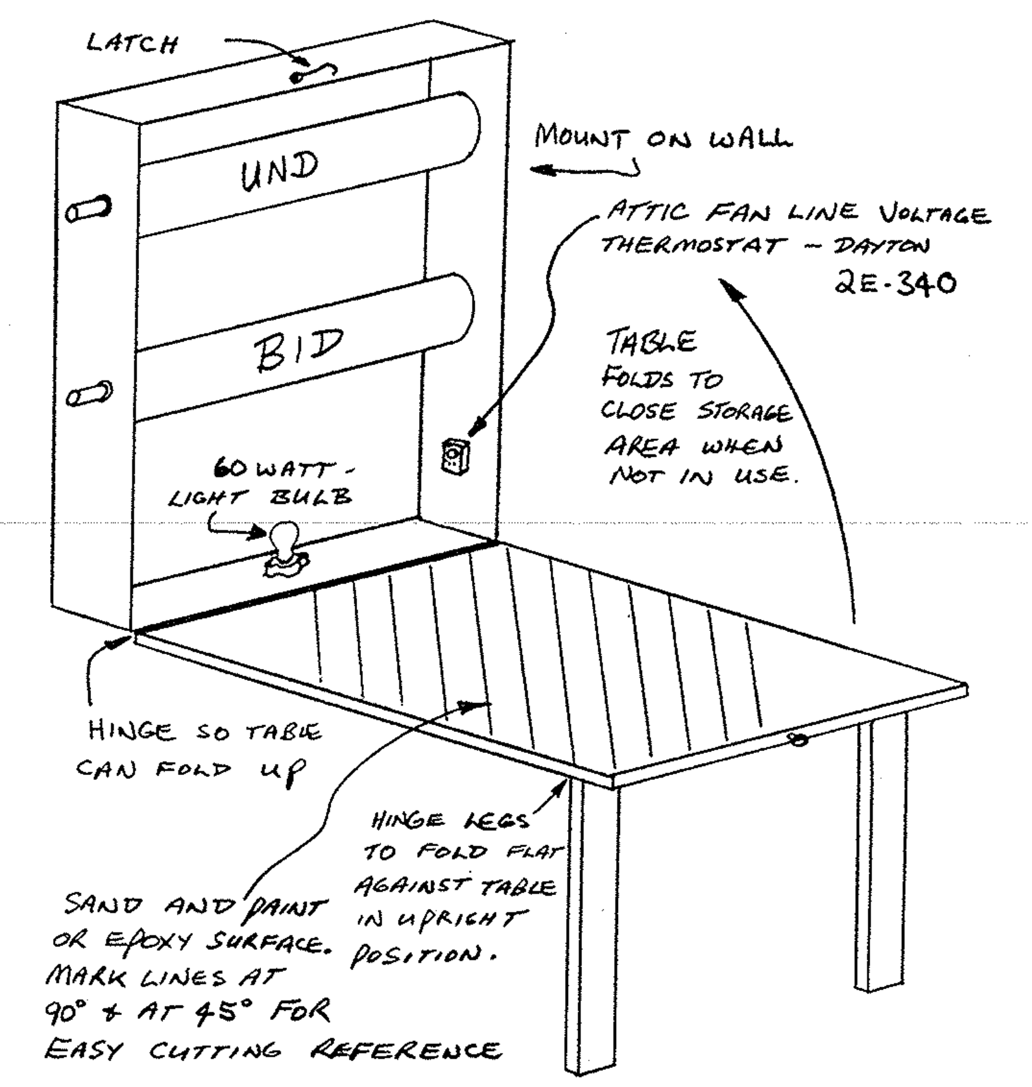
TIME MANAGEMENT

Time management is important with any project but it becomes critical with a foam and fiberglass composite sandwich structure. With other types of aircraft construction it is possible to stop at any point, come back later and pick up where you left off. With epoxy you have to finish a layup once you start. It can take the fun out of working on your project if you get stuck until 2:00 am on Monday night because you started a large layup at 8:00 pm. In these plans, times will not be given for every step. Most of the time is not spent doing layups, but is spent getting ready for the next layup. During these times it is possible to stop at any point.

To help you govern your time as well as the quality of your work you can judge the time in a layup as two minutes per ply per square foot. This does not include applying the micro slurry and peel ply after the last ply. To give an example, the rudder is roughly 1.7 ft high and 1.7 ft average width which means about 3 sq feet. Two plies gives you a total of 6 times two minutes per ply equals 12 minutes. The time between when you start the laminating until the final ply is wet out, should be no more than that per side. We have done this test on several different types of layups and this seems like a good average. If you are very much under or over this figure you are probably working inefficiently. Some parts with several cures or complicated inside layups can take longer but if you are glassing the rudder and the times are off very much get someone with experience to look at your parts or better yet get someone to help you on your next layup to see if you are working properly.

Join your local EAA. This is a group of people whose purpose is to help each other build homebuilt aircraft. There is hardly an EAA chapter around that does not have someone in it that has not built or is building a VariEze or a Long-EZ. These people are using the same materials and techniques as the Defiant. Last you can bring parts into Rutan Aircraft and we will be happy to inspect them. The thing to remember is that slower is not better.

An excellent method of storing glass on the rolls is to build a wall mounted closet as shown. The 'door' folds down to become the cutting table. A 60 watt light bulb will keep the humidity down and thus keep your cloth dry. If you want to get really sophisticated, you can install a Dayton 2E-340 line voltage, attic fan thermostat to control the temperature of the closet. If you sand and paint varnish or epoxy onto the top surface of the cutting table, it will not snag the glass. Marking 90° and 45° lines on the table every 6" will help when it comes to cutting the glass. When you are not cutting glass, fold the door up and latch it to keep dust from contaminating your rolls of glass. The table legs should be hinged to fold flat with the door closed.


LATCH
MOUNT ON WALL
UND
ATTIC FAN LINE VOLTAGE THERMOSTAT - DAYTON 2E-340
BID
TABLE FOLDS TO CLOSE STORAGE AREA WHEN NOT IN USE.
60 WATT LIGHT BULB
HINGE SO TABLE CAN FOLD UP
HINGE LEGS TO FOLD FLAT AGAINST TABLE IN UPRIGHT POSITION.
SAND AND PAINT OR EPOXY SURFACE. MARK LINES AT 90° + AT 45° FOR EASY CUTTING REFERENCE

AMATEUR-BUILT DEFIANT INSPECTION CRITERIA

1.0 Scope

This document has been prepared to assist inspection personnel by providing recommended acceptance criteria and acceptable repair practices for the Defiant amateur-built composite sandwich structure.

2.0 Background Information

2.1 Design Criteria.
The materials, methods and practices employed by the amateur builder in the construction of the Defiant type are new to light aircraft construction and may be unfamiliar to the inspection personnel involved with the licensing of amateur-built aircraft. Structural design criteria for the Defiant exceed F.A.R. Part 23 requirements. In-house component testing of the primary flight structure has been conducted to 200% of design limits. Detail documentation of test data is on file at Rutan Aircraft Factory Inc. The aircraft is considered to be a utility category aircraft. Defiant builders are being supplied with a complete owner's manual which specifies all placards, operating limitations, normal and emergency operations, flying qualities, maintenance specifications, inspection procedures and initial flight test procedures.

2.2 Structural Approach.
The basic structure throughout the design is a composite sandwich of load bearing fiberglass skins separated by a light- weight foam core. While the materials and processes are tailored to the amateur builder, the structural layout is very similar to the honeycomb composite structures utilized in military and transport type aircraft and fiberglass sailplanes. Loads are carried by epoxy "E" type fiberglass lamina. Foams of various types and densities are employed as a form (upon which the load bearing material is shaped) and local buckling support. In no instance are foams used to transmit primary loads, as is the case in some other ameteur-built designs.

2.3 Inspection Techniques
The transparent nature of the fiberglass/ epoxy material allows for visual inspection of primary structure from the outside prior to finishing. Defects in the structure, as described in paragraph 3.0, are readily visible even in the deepest laminate.

2.4 Inspection Sequencing
The external visual inspection capability provided by the materials allow inspection of all primary structures at any point before finishing. All primary structures are at the surface, eliminating the requirement for "pre-cover" or "closure" inspections. Opaque filler materials are used throughout the airplane in finishing. Inspection should take place before any areas are obscured. Some areas may have opaque materials applied to one surface where the structure is inspectable from the opposite side (wing trailing edge for example).

3.0 Defects

3.1 Voids.
Interlaminar voids in a new layup may be due to small air bubbles trapped between plies during the layup. These void areas look white and are distinctly visible even deep in a cured layup. Interlaminary voids up to 1 inch in diameter do not require repair, as long as they do not consist of more than 5% of the surface area. Voids greater than 2 inches in diameter should be repaired as shown in paragraph 4.

3.2 Lean Areas
Areas where the epoxy/glass matrix is incomplete because of inadequate wetting of the cloth with epoxy (lean areas) are speckled whitish in appearance. The fully wetted laminate will have a consistent transparent brownish appearance. Epoxy lean areas are acceptable, as long as the white speckled area is less than 10% of the surface area. White to brown ratios greater than 10% require rejection or repair as shown in paragraph 4.

3.3 Rich Areas
Resin richness primarily adds weight to the laminate. While some degradation of physical properties does occur, an overly wet (rich) layup is not grounds for rejection.

3.4 Inclusions.
Bristle paint brushes are used throughout the layup process. As a brush begins to deteriorate it will shed some bristles into the laminate. The bristle inclusions, up to 20 bristles per square foot, are not cause for rejection. Occasional inclusion of small woodchips or other small foreign objects is not ground for rejection.

3.5 Fiber disruption
In all instances, it is good practice to have the glass fibers laying flat and without wrinkles. Major wrinkles or bumps along more than 2 inches of chord are cause for rejection in the wings, canard and winglets, particularly on the upper surfaces (compression side). Disruptions greater than 2 inches require repairs per paragraph 4.

3.6 Finishing Damage
Damage to the external structure by sanding in preparation for surface fill and paint can occur. Occasional sanding through the weave of the first skin ply is not grounds for rejection. Sanding through areas greater than 2 inches in diameter completely through the first ply or any damage to interior plies must be repaired in accordance with paragraph 4. A damp rag passed over the sanded surface will make the plies show up to determine how many plies have been sanded away.

3.7 Service Damage
Damage to the glass structure will be evidenced by cracked paint, or "brooming" of glass fibers. Both of these indicators are clearly visible. If either type of indication is present the paint and filler should be sanded away, bare laminate inspected and repairs made per paragraph 4 as required. Where surface damage has occured it is also likely that local foam crushing has been inflicted.

3.8 Delaminations
Delamination of glass/epoxy lap joints is evidenced by physical separation of plies. These defects are easily visible and easily repaired. The leading and trailing edges of flying surfaces (wing, canard, winglets) should be free of delaminations.

3.9 Multiple Defects
Where multiple types of small defects occur in a laminate (voids, fiber dislocations and lean areas for example). They should not exceed a total of 10% of the surface area of the laminate, or 20% of the wing chord at any one spanwise position.

4.0 Repairs

There are seldom single defect so massive that a major component must be scrapped. The repair procedures described here may be applied throughout the Defiant composite sandwich structure.

4.1Small Void Repairs
Voids up to 2 inches in diameter may be repaired by drilling a small hole into the void and injecting the void full of epoxy. A vent hole opposite the injection point is required to allow air to escape.

4.2 Large Defects
Excessively large voids, lean areas, finishing damage, fiber disruptions, major fiber wrinkles, or service damage may be repaired using this procedure. Remove the rejected or damaged area by sanding or grinding and taper the glass laminate on a slope of approximately 1 inch per ply in all directions. The plies are visible as the sanding is done. The tapered glass edges and surrounding two inches of glass surface must be sanded completely dull. Damaged underlying foam should be removed and the void filled with a dry microsphere/epoxy mixture or a replacement foam piece. The damaged area is then laminated over using the same type and orientation of glass plies removed, each ply lapping onto the undamaged glass at least one inch.

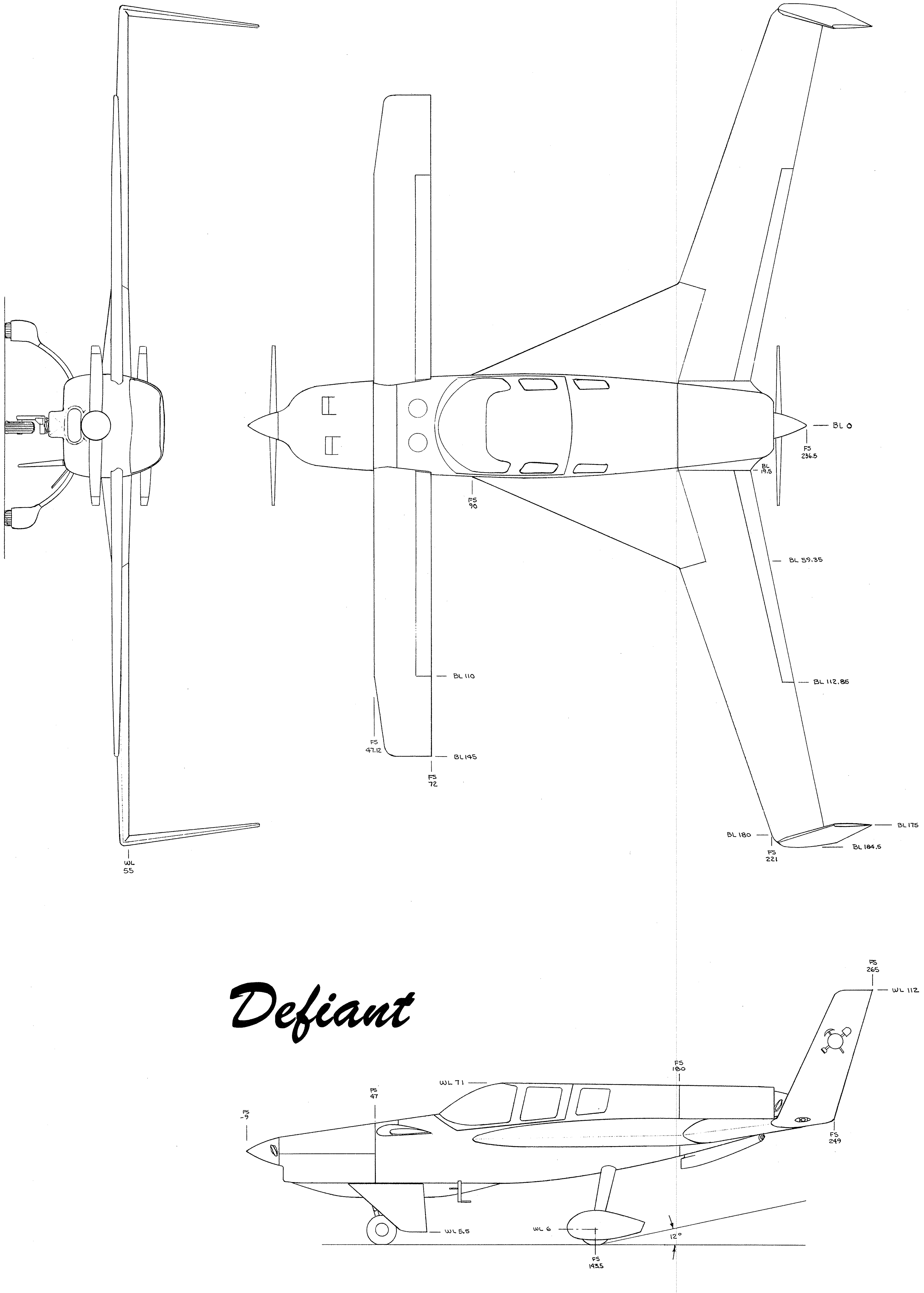
4.3 Delaminations
A delaminated joint should be spread, the mating surfaces sanded dull, gap filled with flox (epoxy/flocked cotton mixture), then clamped shut while it cures.

5.0 Materials

Since a wide range of similar appearing materials exist which exhibit substantial differences in physical (structural) properties, Rutan Aircraft Factory Inc. has established a distribution system to provide the amateur builder with proven acceptable materials. RAF strongly discourages the substitution of materials. Homebuilder substitutions for the basic structural materials constitutes major structural modification to the Defiant design, and could adversely effect flight safety.

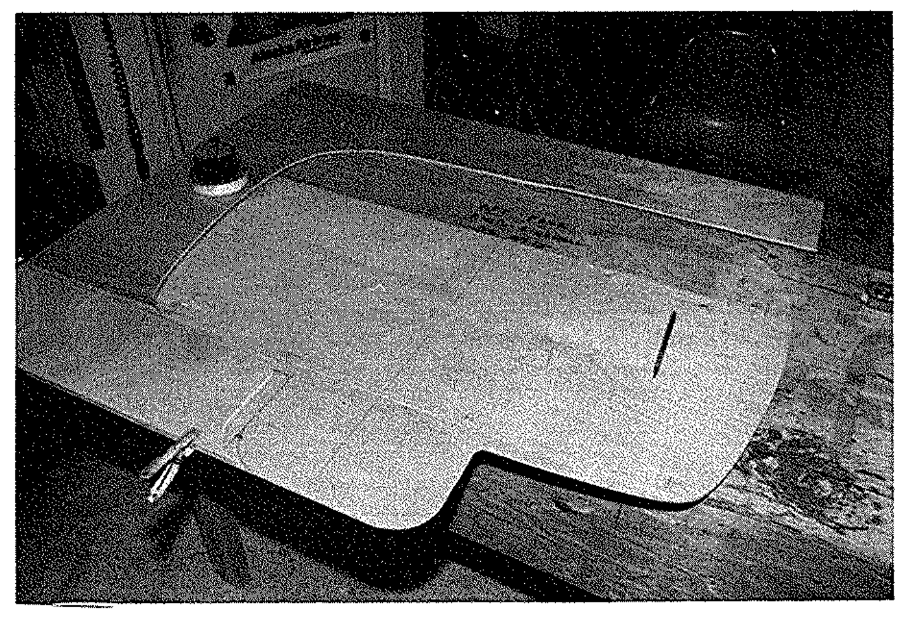
6.0 Applicability

These acceptance criteria are different from and, in some cases, much looser than for similar structures found in sailplanes and other contemporary composite structures. These criteria apply only to the Defiant structures. Design safety factors in excess of these enable somewhat relaxed acceptability criteria compared to other similar structures.

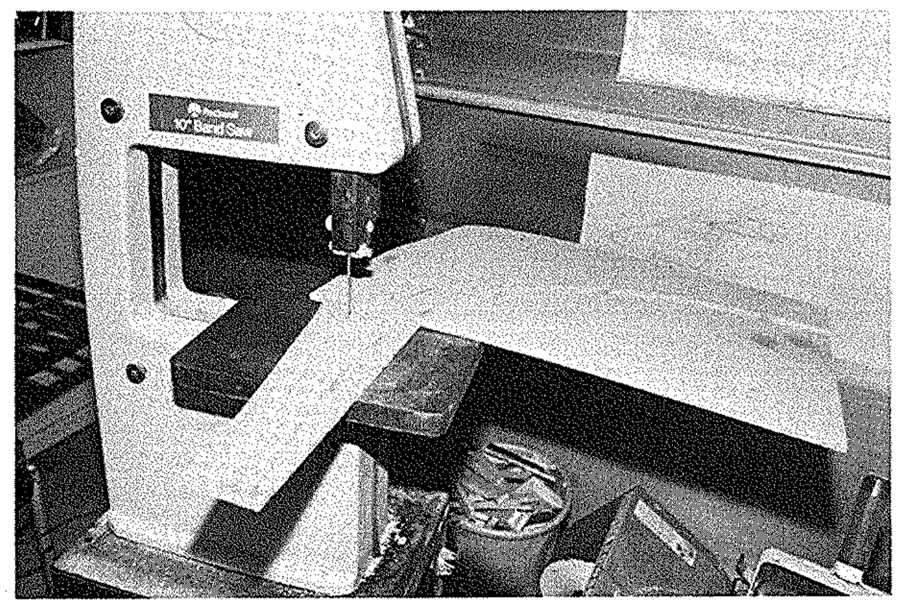


Defiant

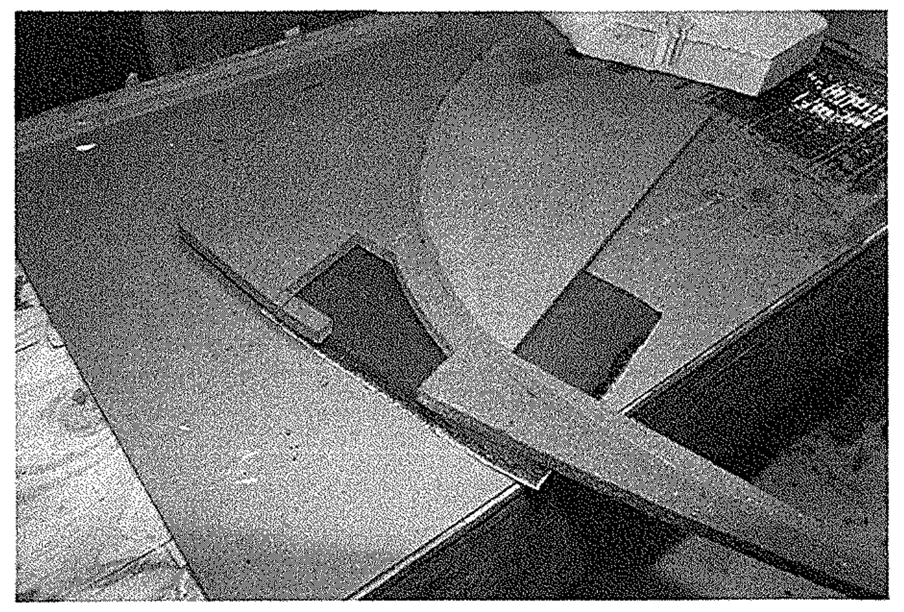
1/20 SCALE



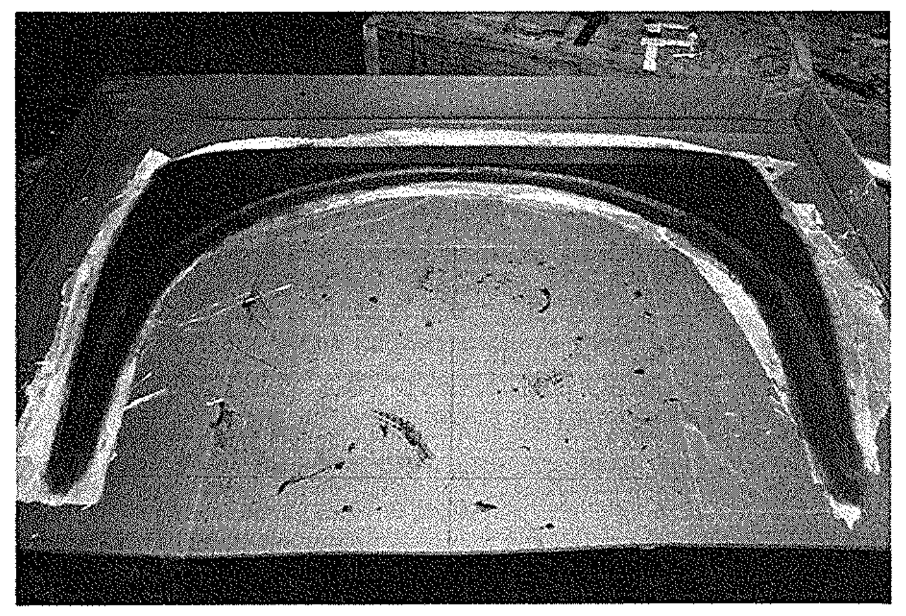
1. Forward firewall - Note offset in nose gear box (LOWER PORTION).



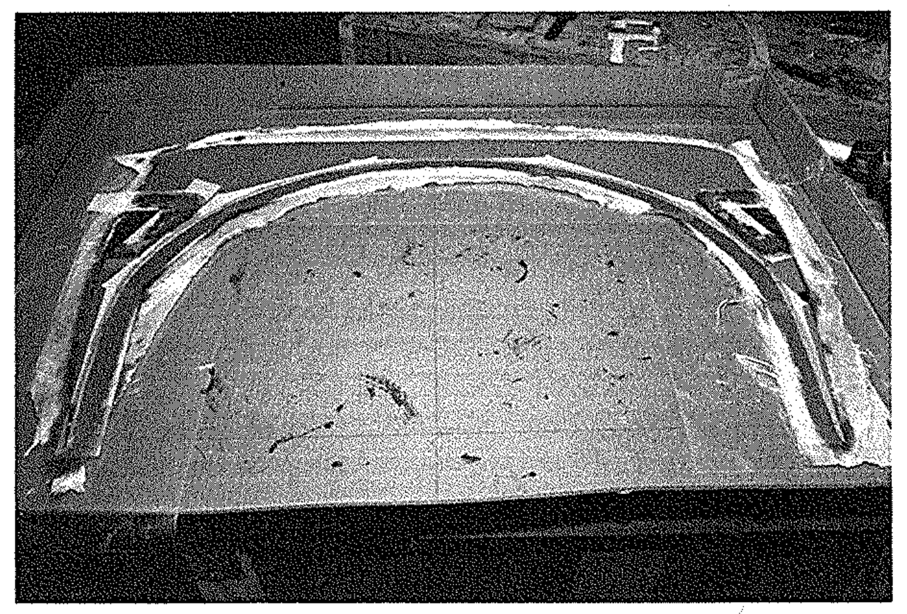
2. Canard attached to BULKHEAD 57. Stack sawing two halves to make true outline. (SEE D-11).



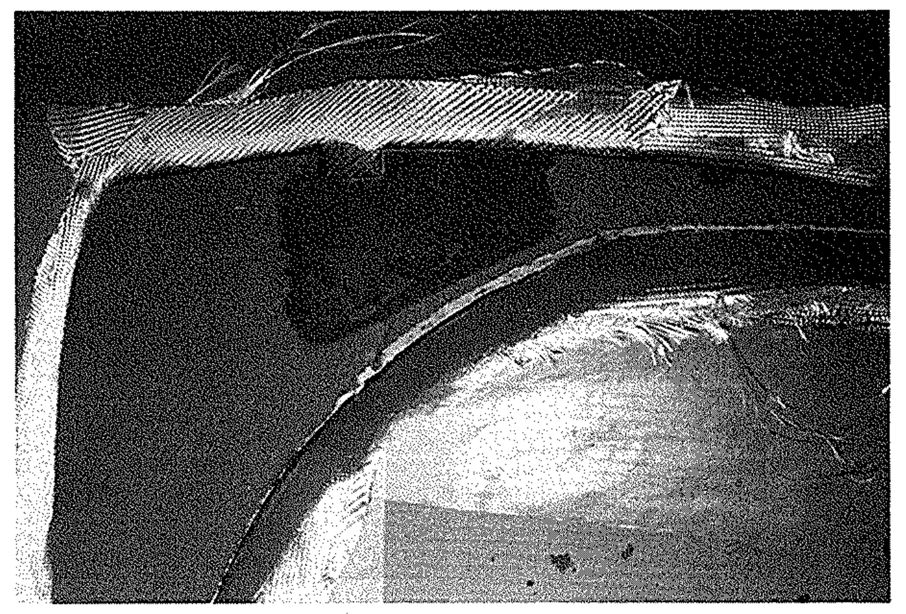
3. Outlining 1/4" solid BID insert in Bulkhead 57. (SEE D-11).



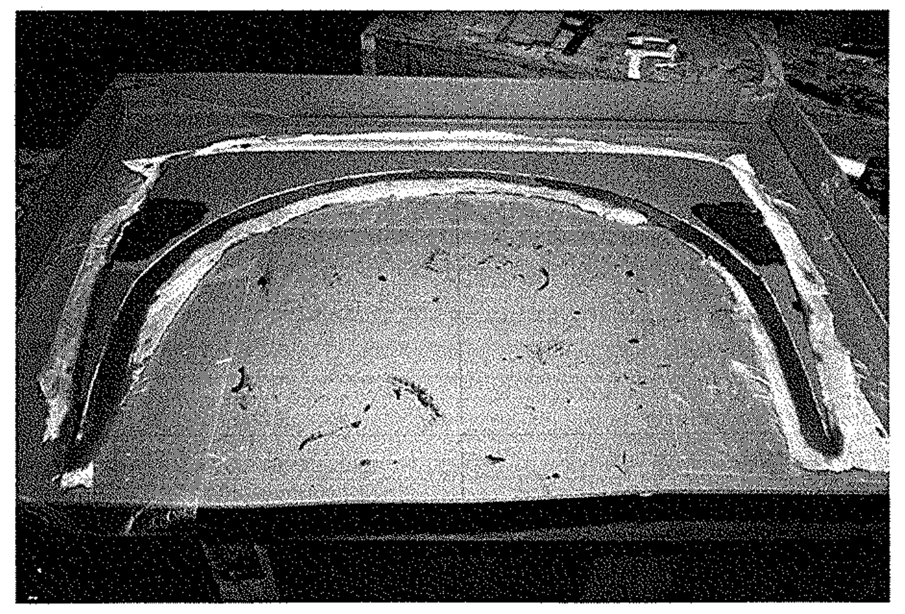
4. Bulkhead 57. Glassing AFT side (SLURRY ALL FOAM).



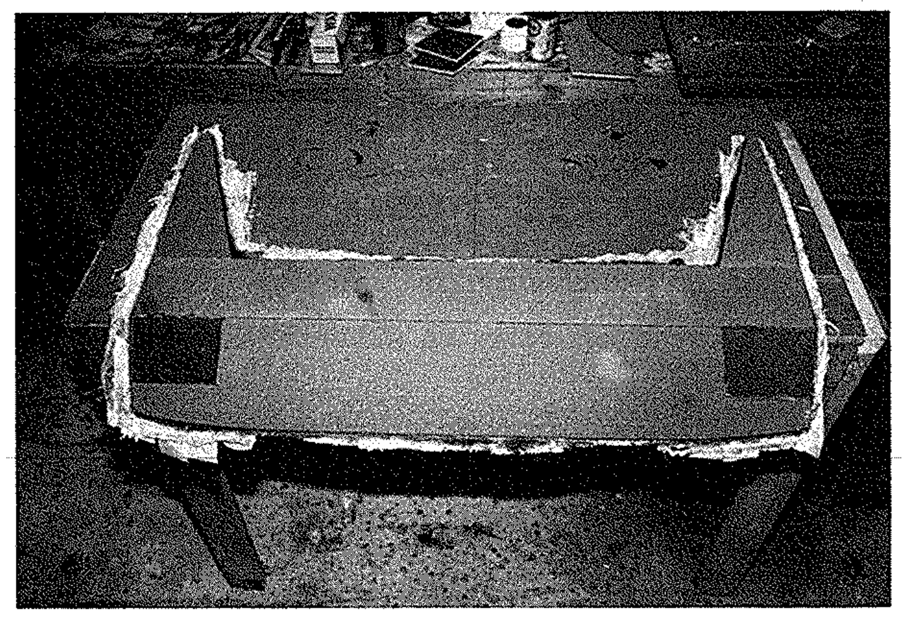
Forward side of BULKHEAD 57 after aft side is and turned over. Note use of PEEL PLY to for forward side layup.



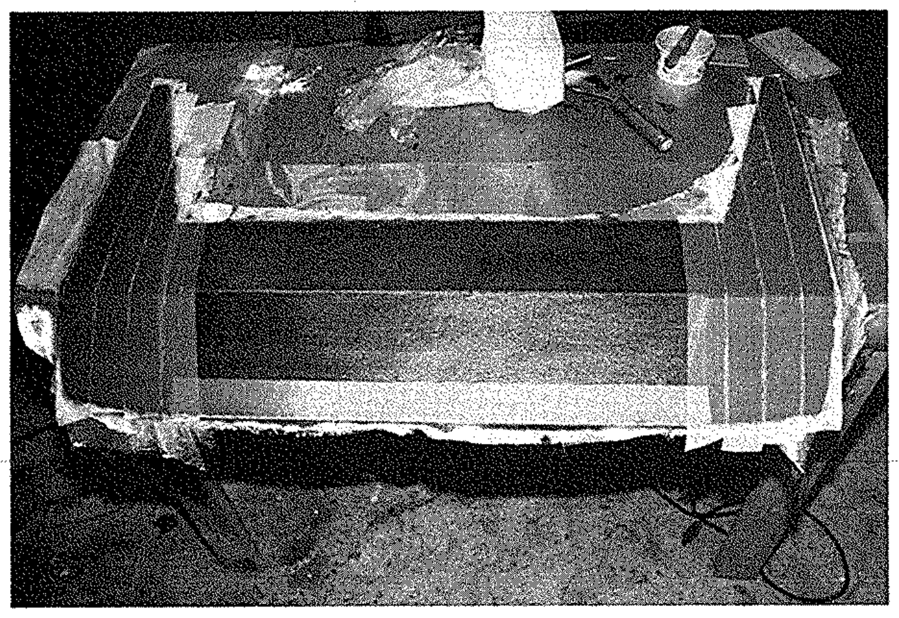
6. Close view of 1.4" solid BID insert in BULKHEAD 57.



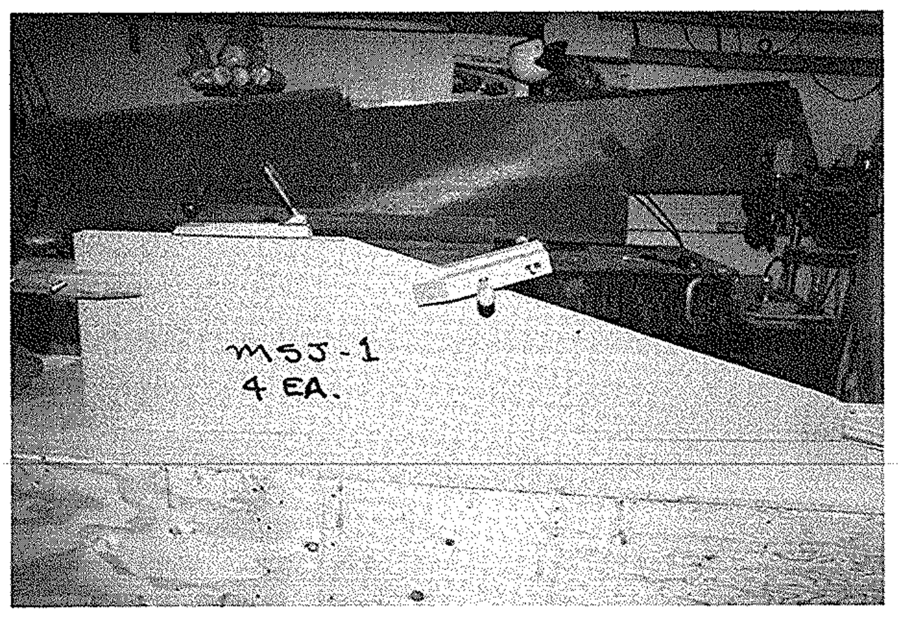
7. BULKHEAD 57.



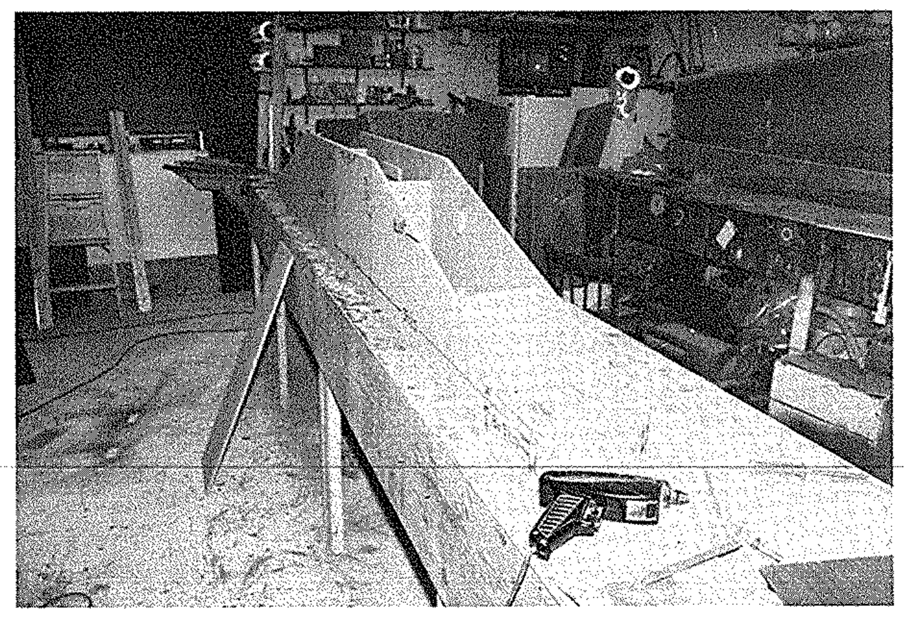
8. BULKHEAD 114.5 (Forward main gear bulkhead). Note, both 1.4" solid BID inserts. (SEE D-15).



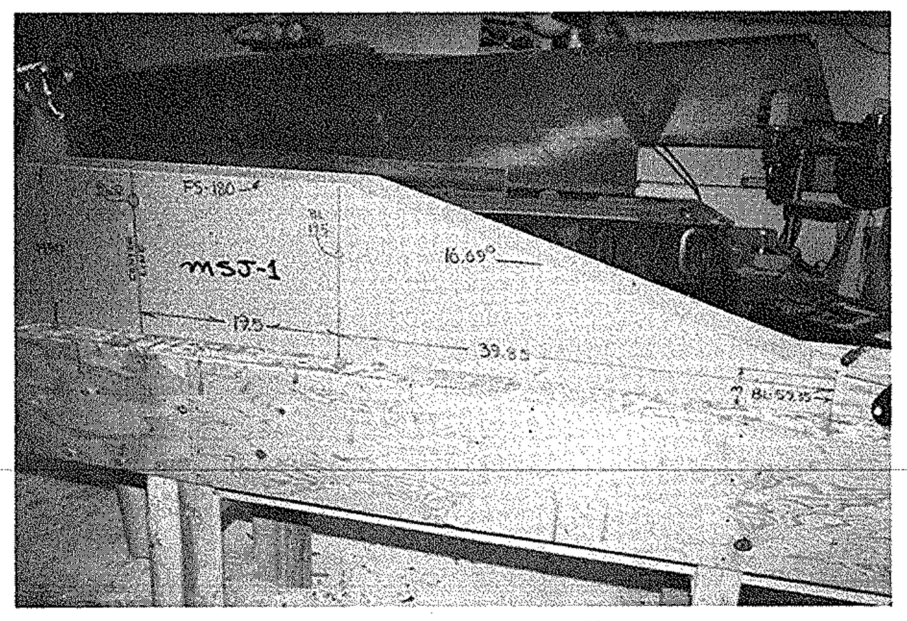
9. BULKHEAD 144.5 . Note use of PEEL PLY. (SEE D-15).



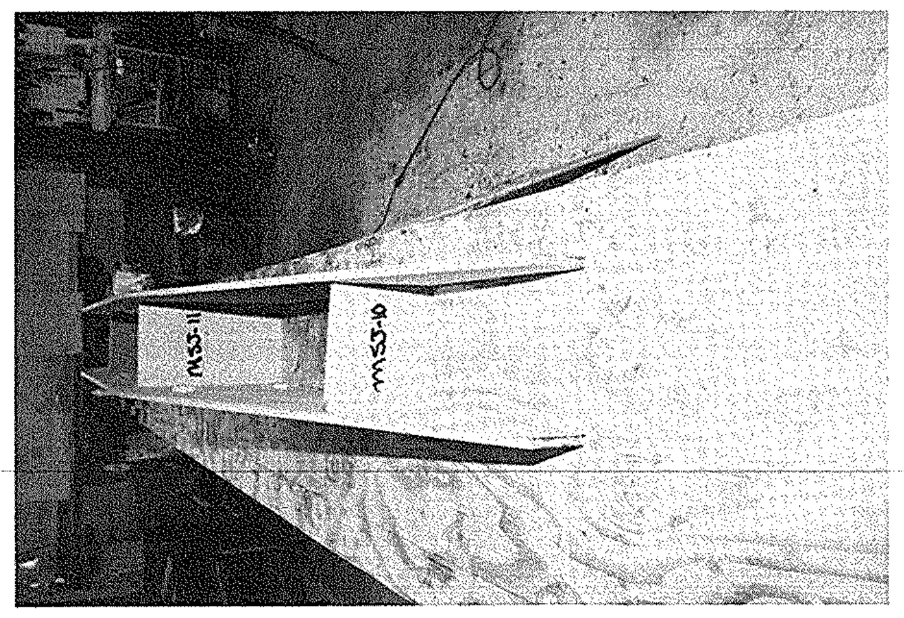
10. 4 pieces to form sides of center section (main carry through) spar jig. (SEE D-18).



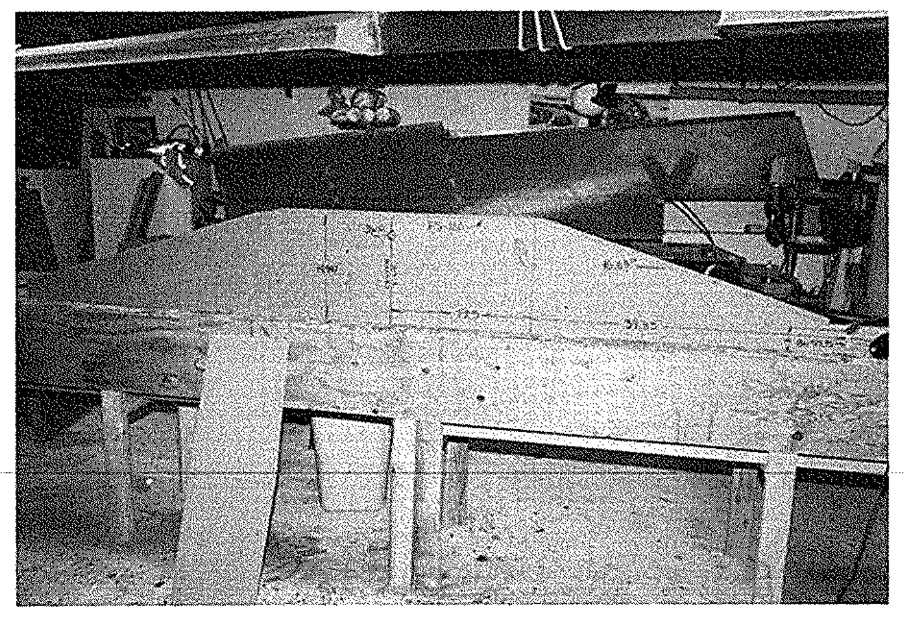
11. Laying out Centersection Spar jig sides - Note measurements.



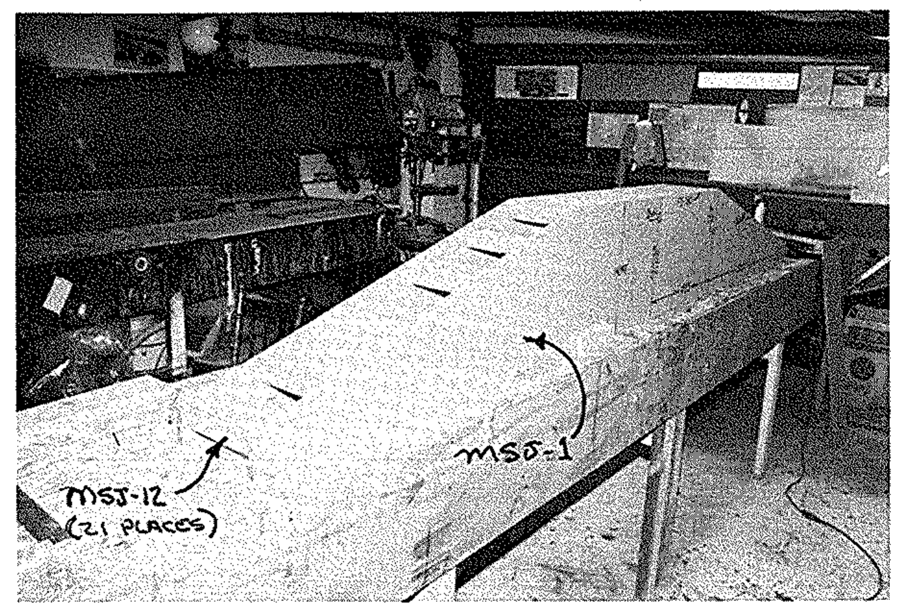
12. Centersection Spar Jig.



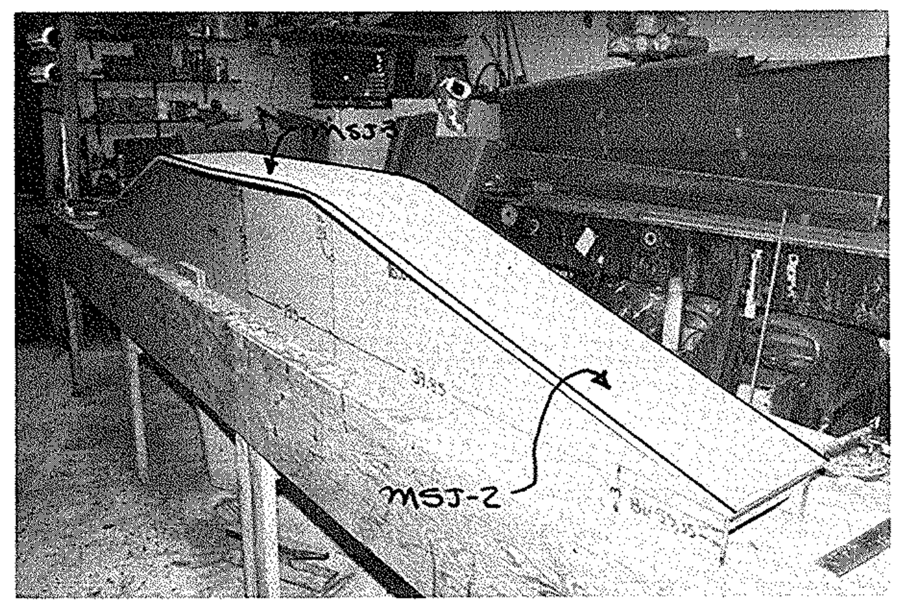
13. Continue Jig.



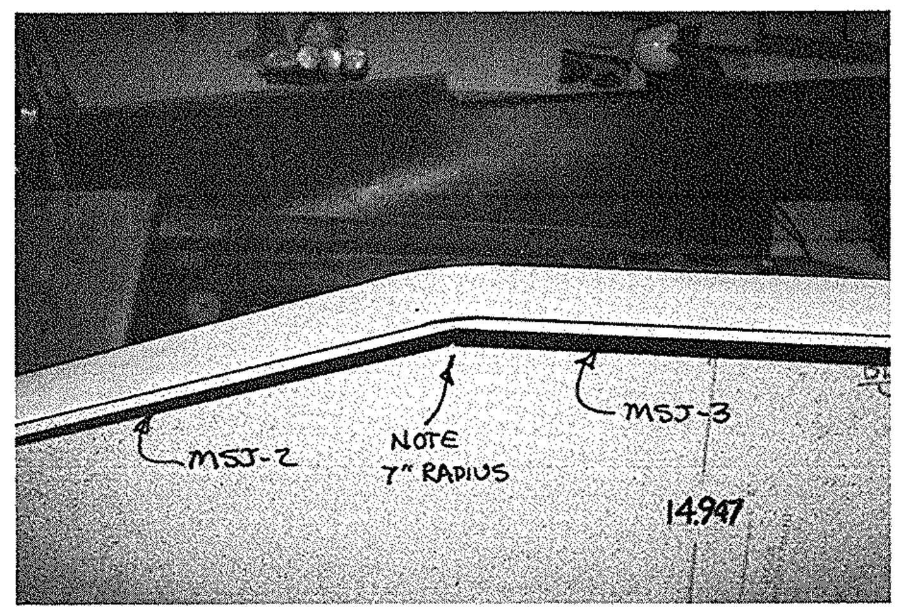
14. Continue Jig.



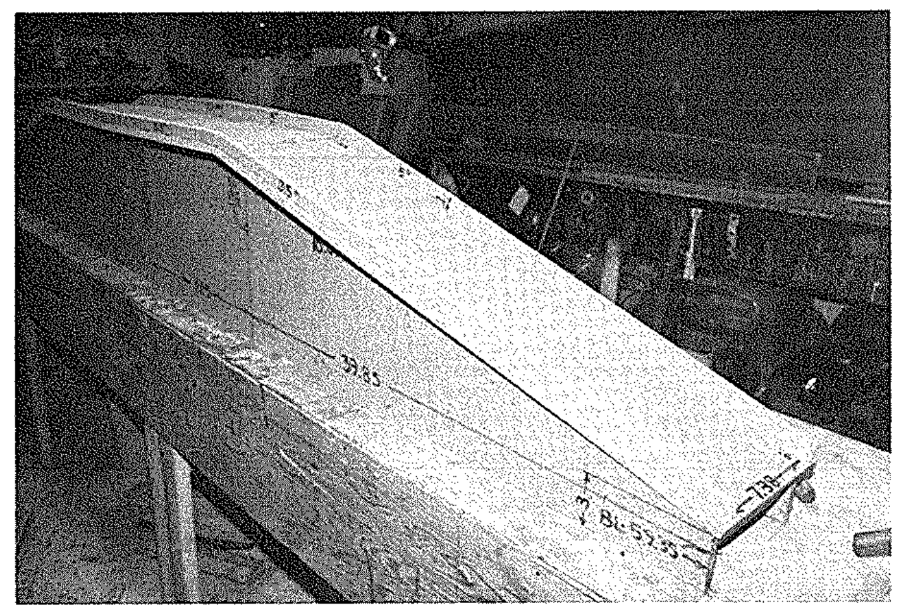
15. Put cross pieces in (MSJ-12's) 21 PLACES.



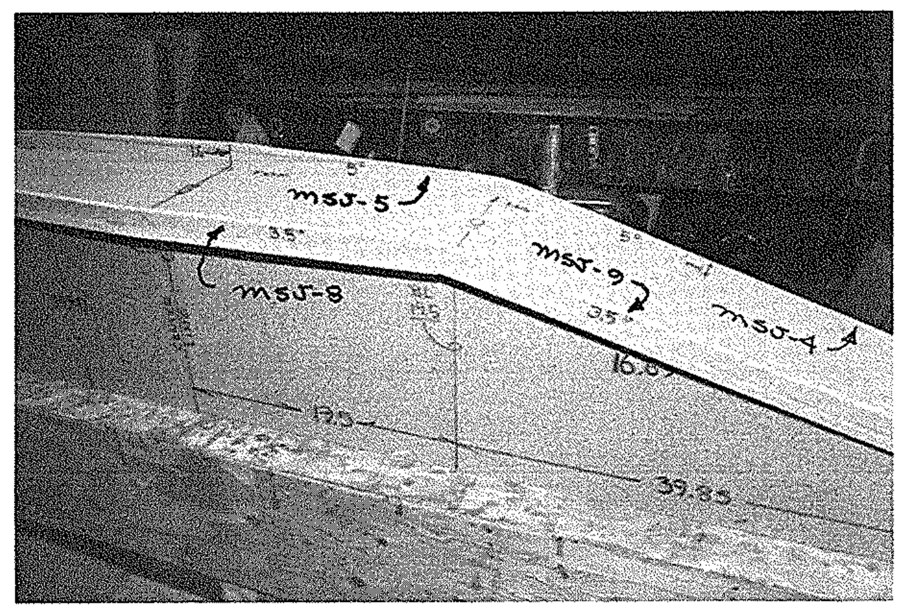
16. Putting top on Centersection Spar jig.



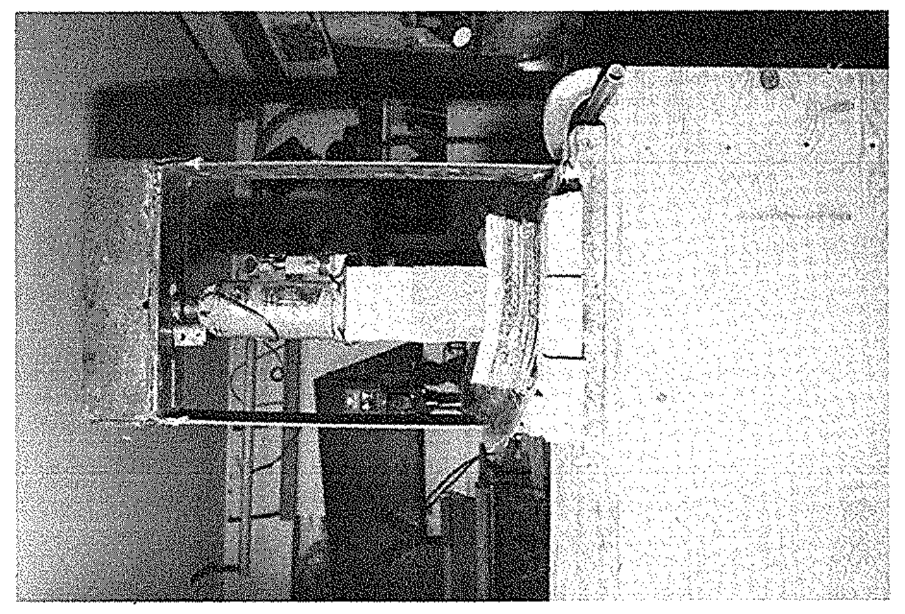
17. Note 7" radius in joint between MSJ-3 and MSJ-2. Typical both sides. Provides needed curve in Centersection Spar to prevent kink.



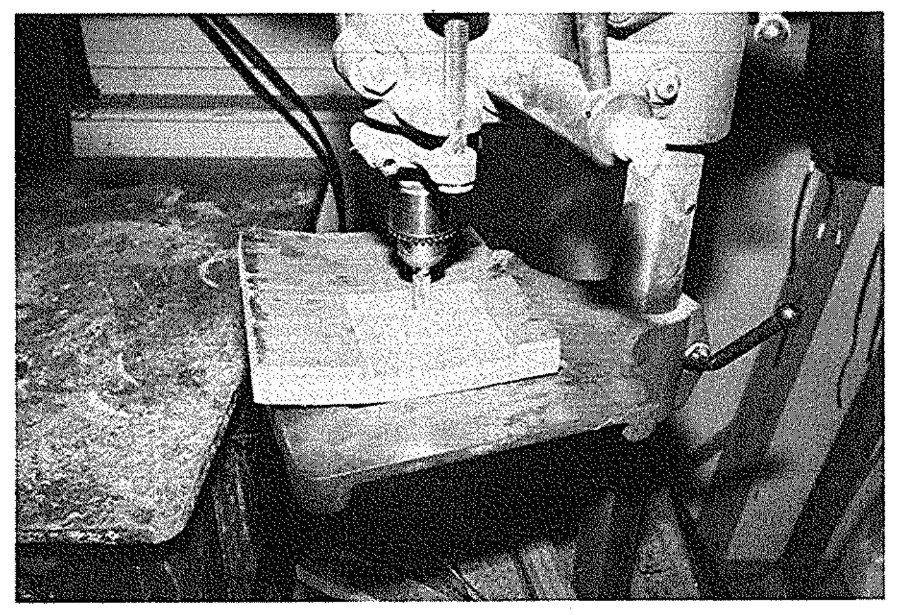
18. Adding side rails - Note 5° angle of top rail and 3.5° angle of bottom .



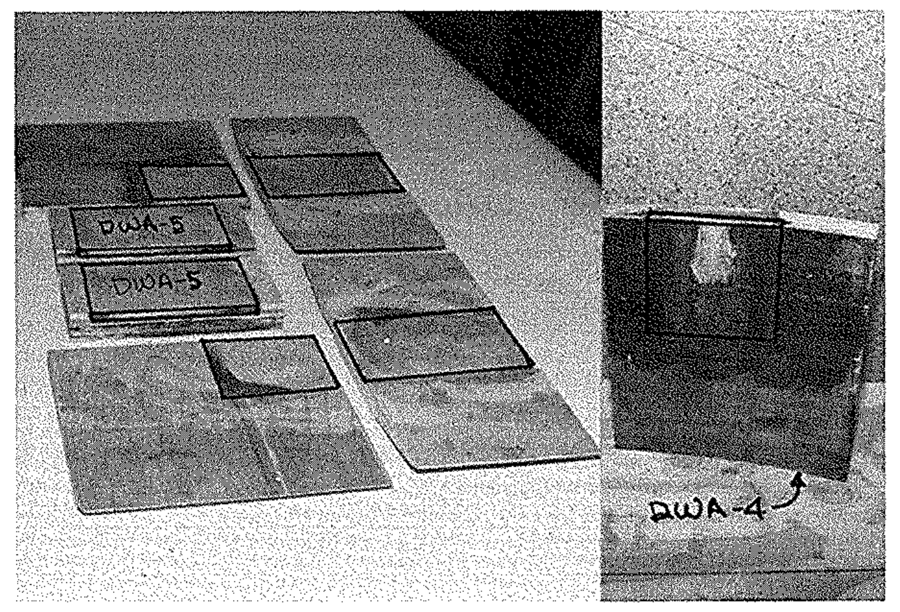
19. Side rails.



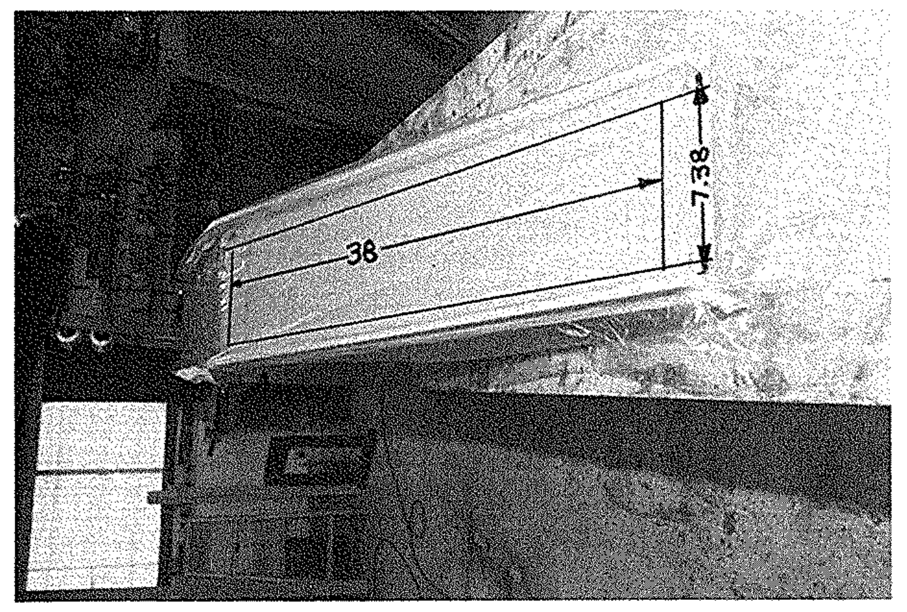
20. Using hydraulic jack to form 1.8" plywood to make DWA-4 and DWA-8. (SEE D-19). NOTE: Both DWA-4 and DWA-8 can be formed at same time.



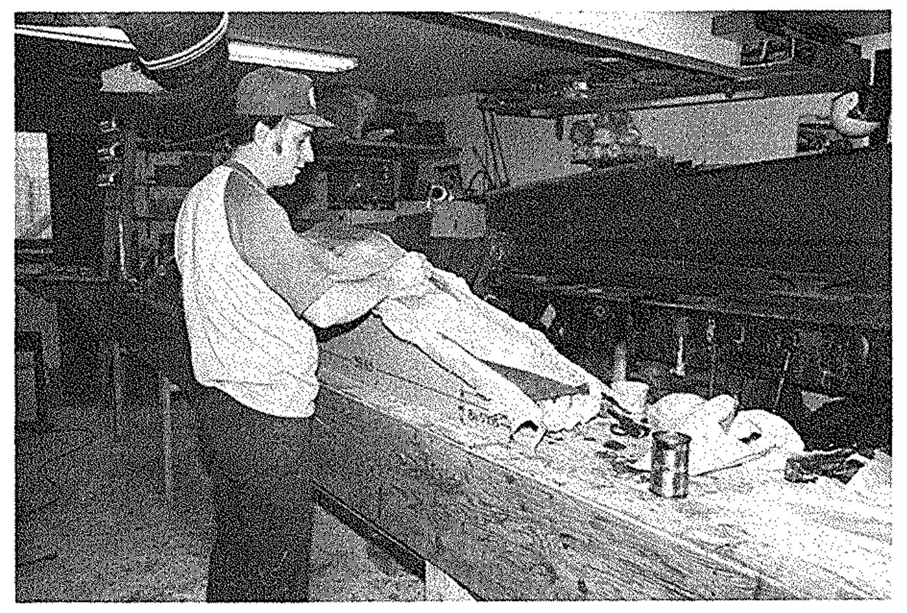
21. Routing out DWA-4 for 1/4" solid BID insert.



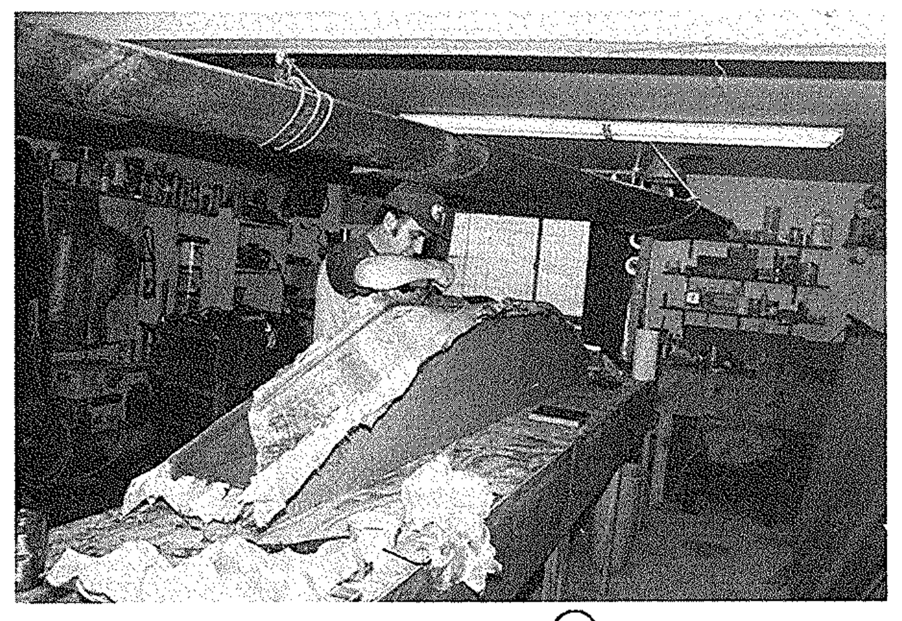
22. Hard points (wing and centersection spar) for wing attachment.



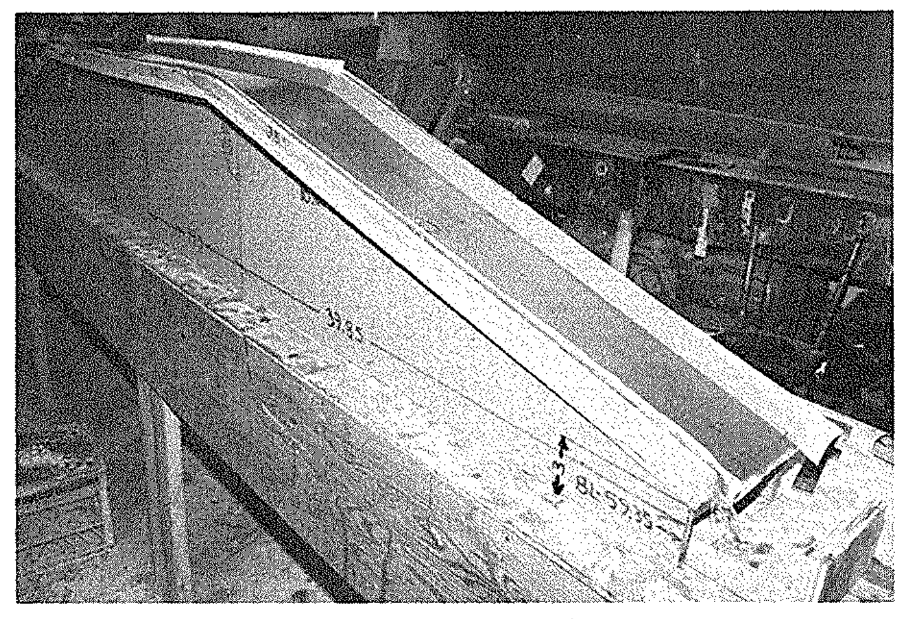
23. CENTERSECTION SPAR JIG. NOTE: 38" between center line of attach points. (SEE D-19 and D-30). Cover surface of jig with Saran Wrap.



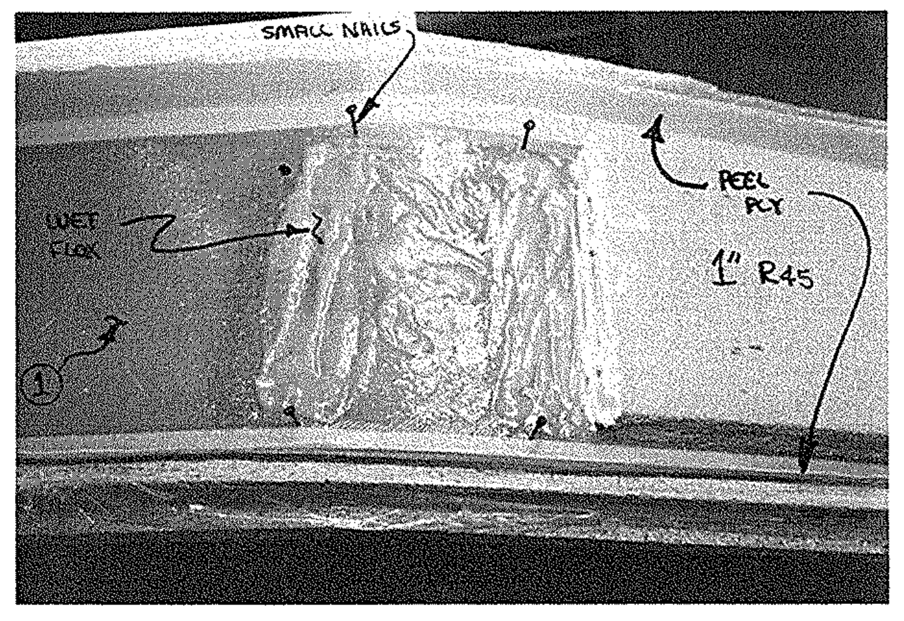
24. Layup ① 6 Plies UND ± 45°.



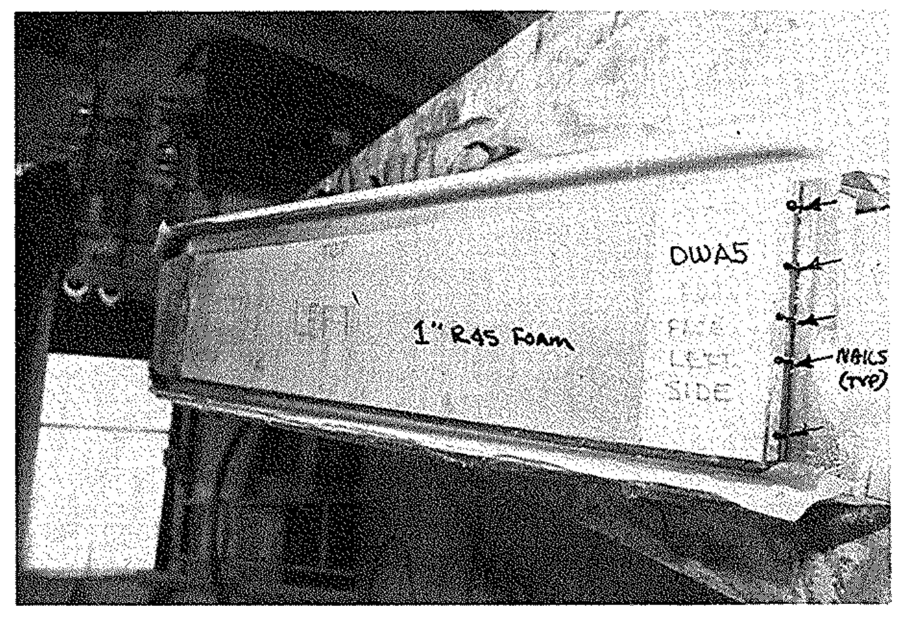
25. Continue layup ①.



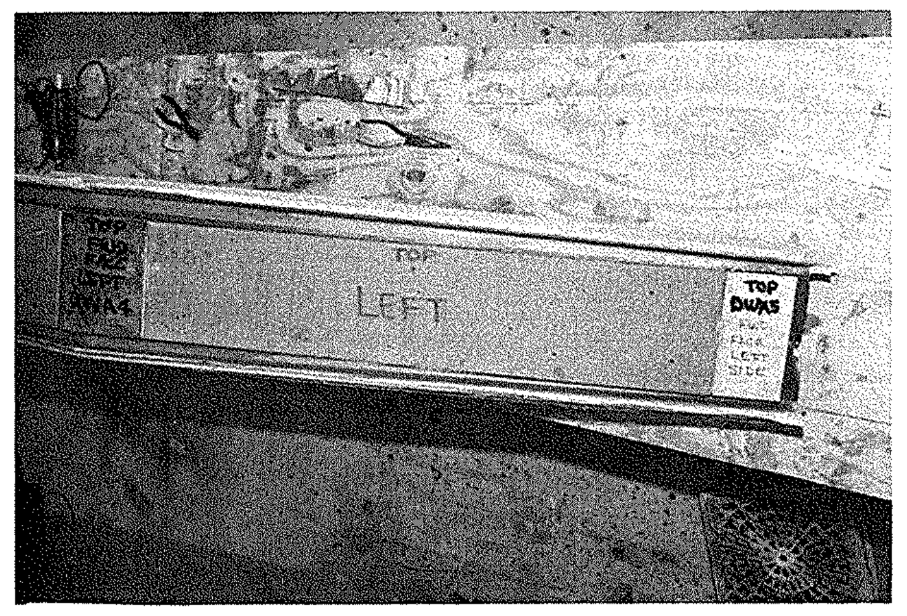
26. Add PEEL PLY to spar trough area to prepare surface for later spar cap layup.



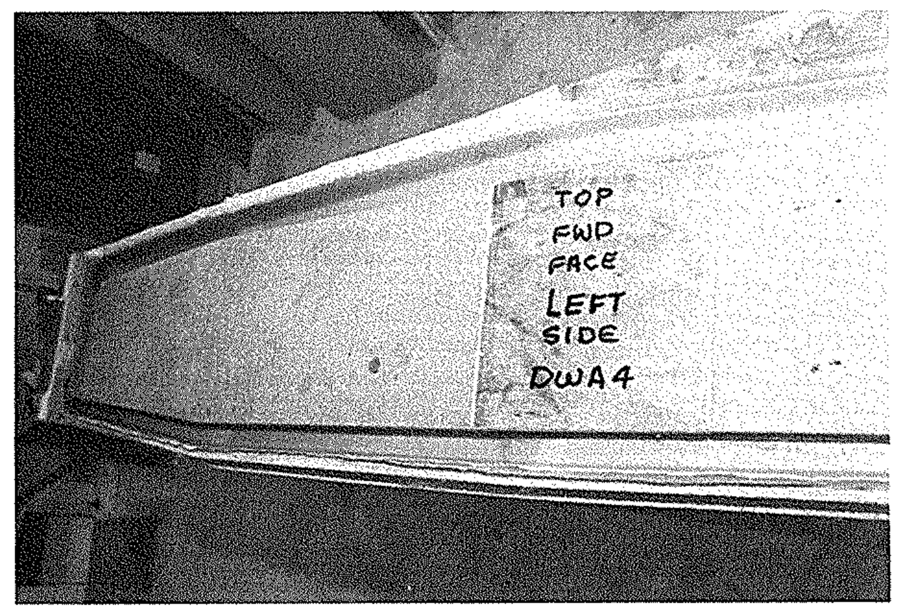
27. Adding pre-shaped (CUT TO SIZE 1" R45 foam) and wet FLOX for DWA-4.



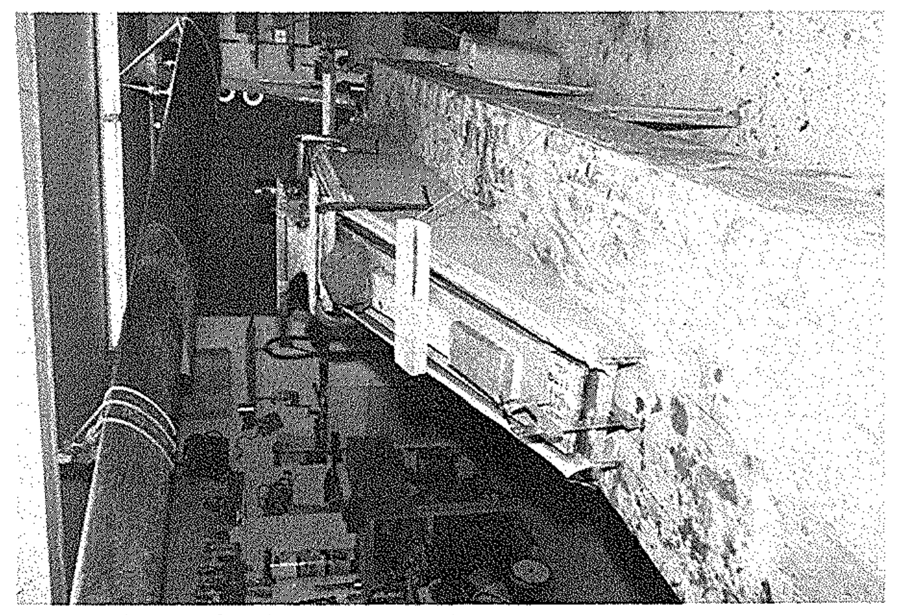
28. DWA-5 location. NOTE: Use of small nails to hold block (DWA-5) in place.



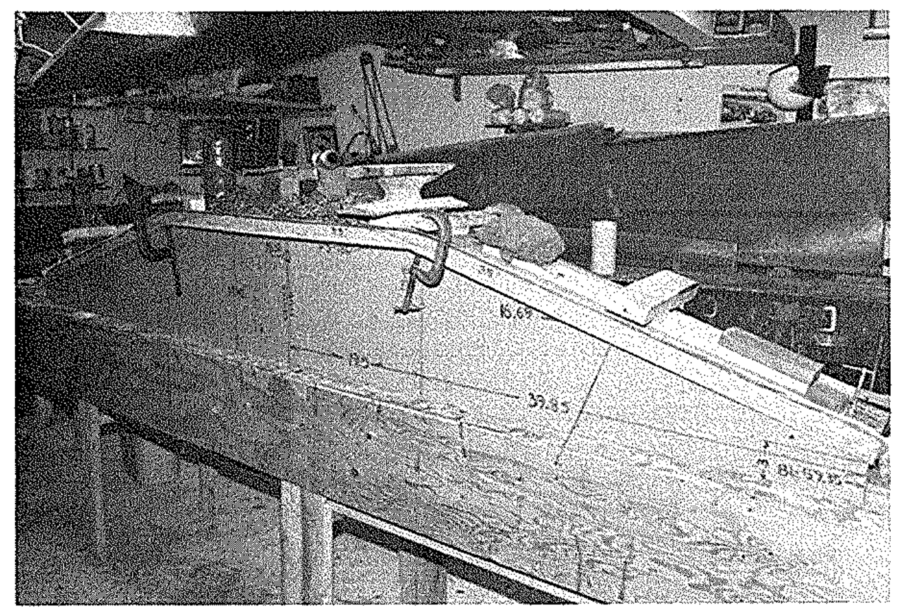
29. SLURRY SIDE OF 1" R45 contacting layup ①.



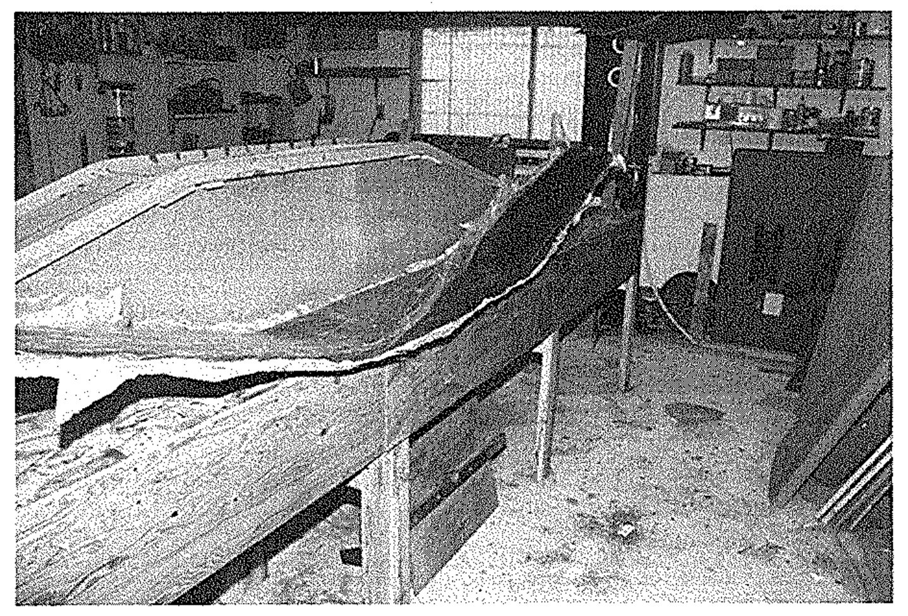
30. Center area of spar is thicker than 1" top side of centersection spar - it is necessary to shape a R45 piece to add needed thickness. MICRO in place. (SEE Section A-A D-19).



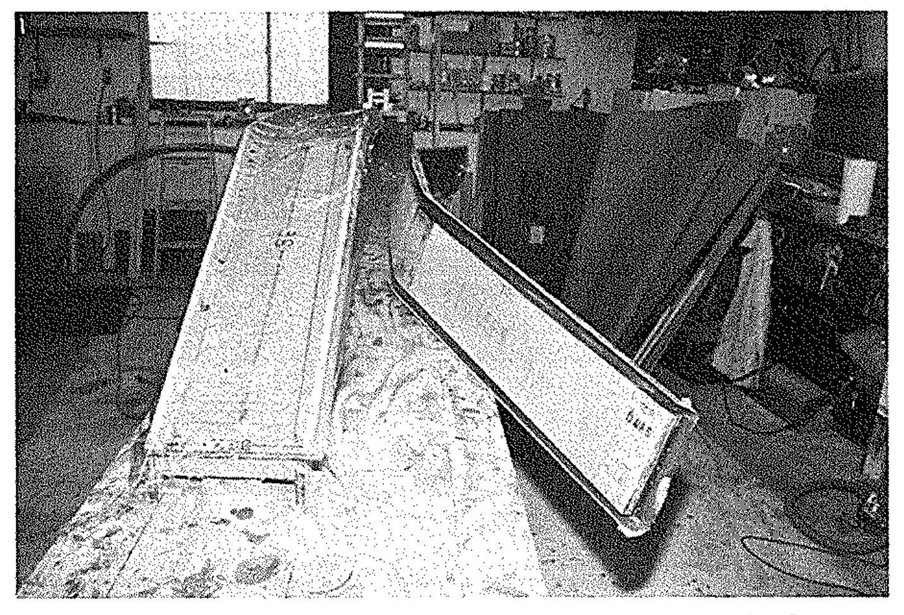
31. After placing hard points and R45 foam, weight project for cure.



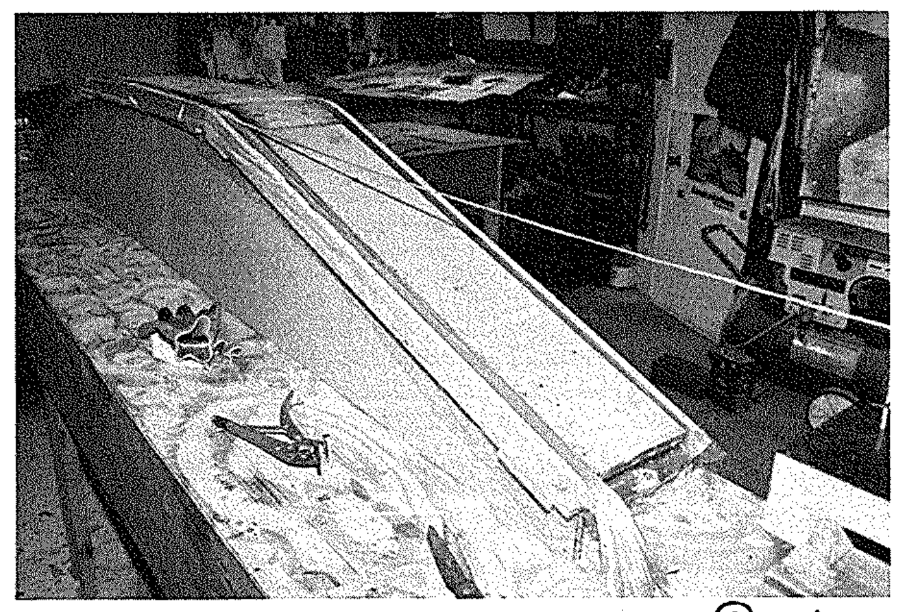
32. Clamping and weight.



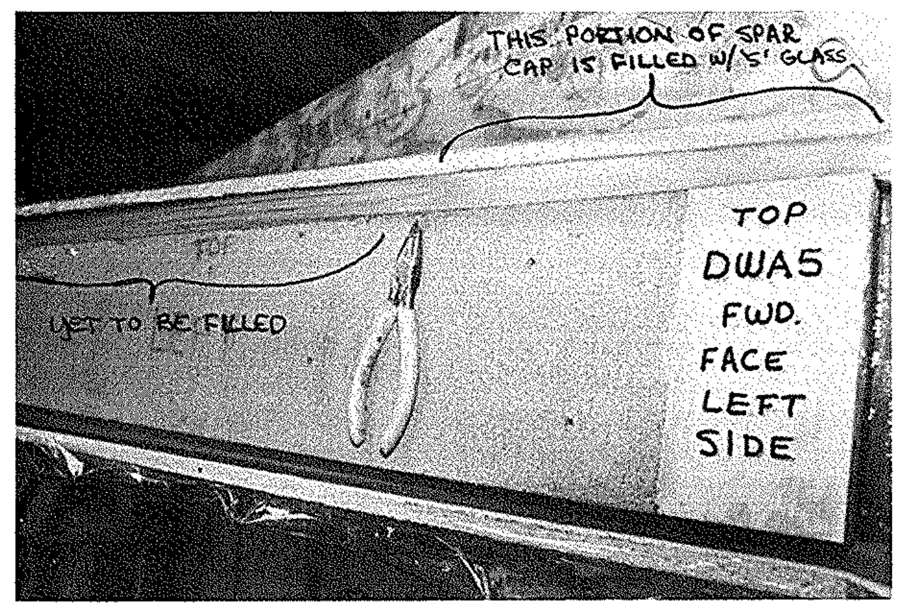
33. Remove spar and Saran Wrap - trim leading edge - top and bottom. See next photo, 34.



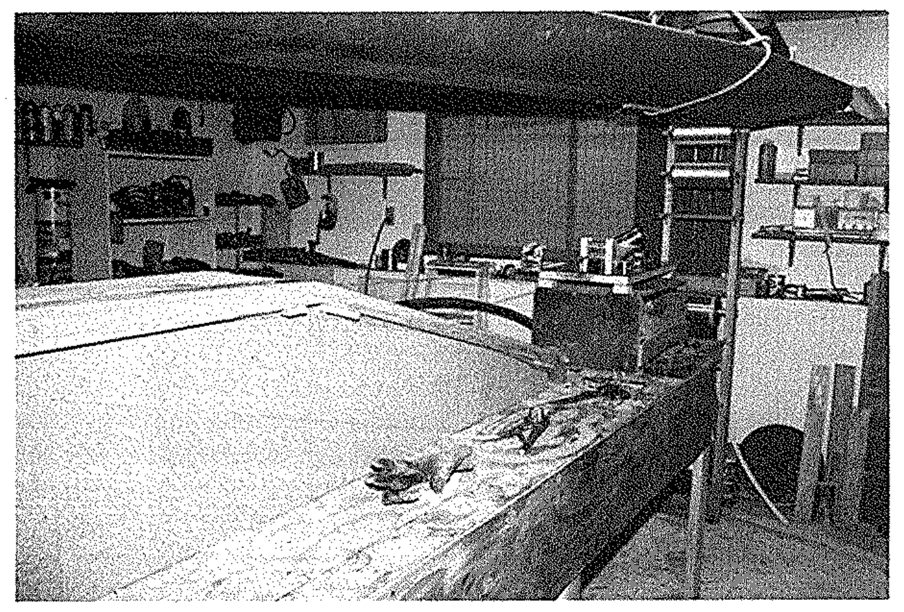
34. Spar trimmed - cover surface again with Saran Wrap. Reinstall spar.



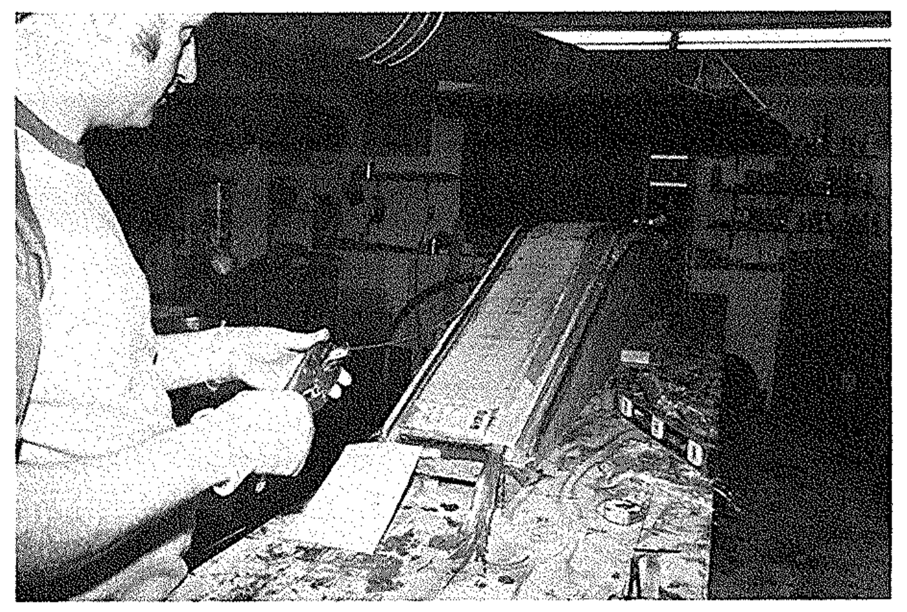
35. Remove PEEL PLY and do spar cap layup ② using 'S' glass. Continue to apply strands full length until full, then progressively shorter strands. (First strands are longest - last strands are shortest).



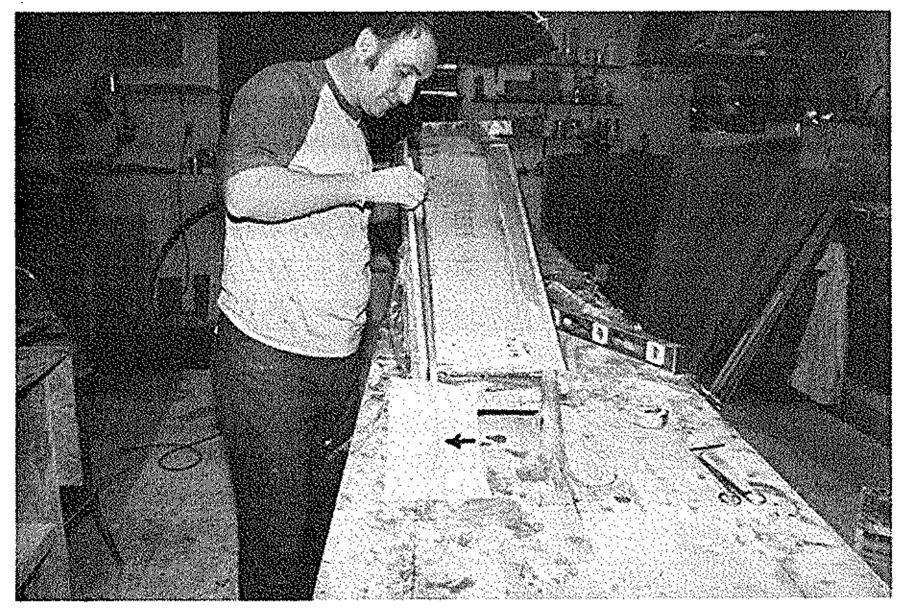
36. Nose of pliers indicate where spar cap is filled with 'S' glass. RIGHT of pliers is full - left is yet to be filled. NOTE: Opposite but same situation will be at other end of cap.



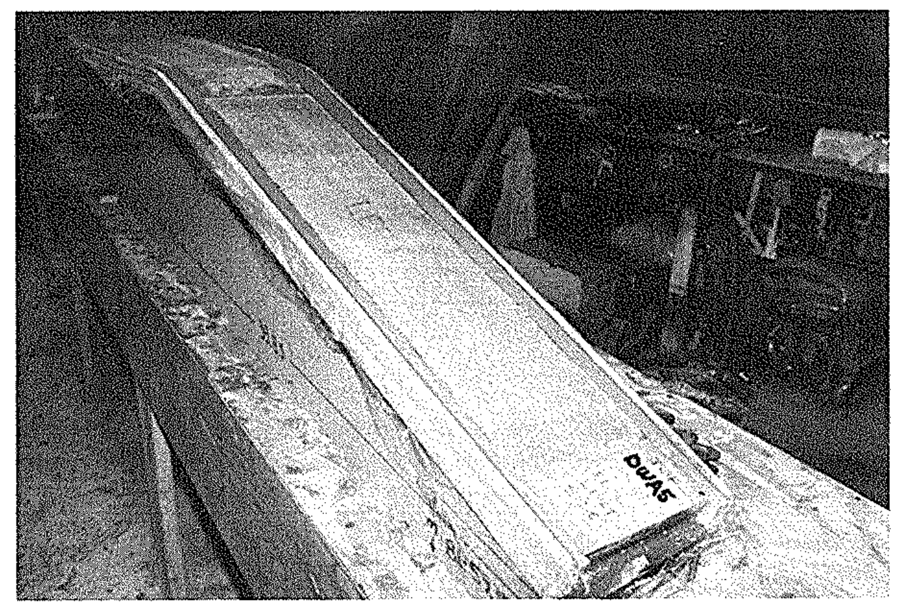
37. 'S' glass rack and wetting machine.



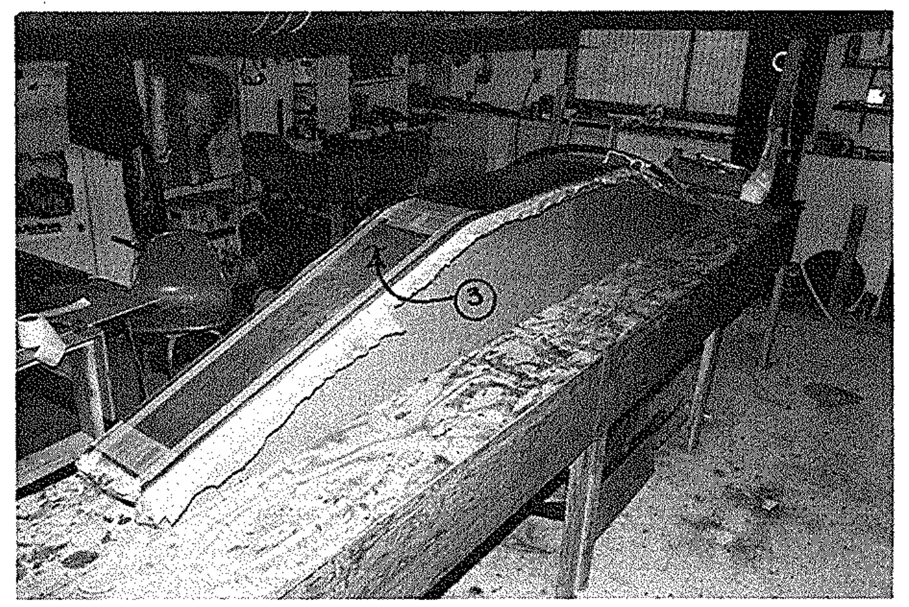
38. Pulling out individual 'S' glass strand from wetting machine laying such in bottom spar cap. NOTE: Top spar cap is completed and peel plied.



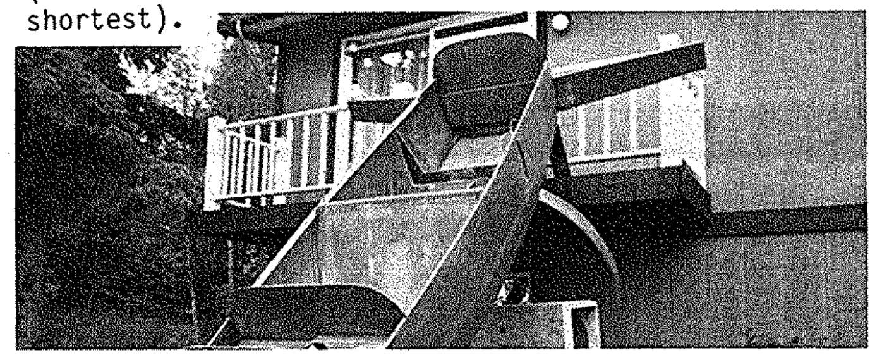
39. SQUEEGEE out 'S' glass after placing 8 to 10 strands. NOTE: Strands laying on paper.



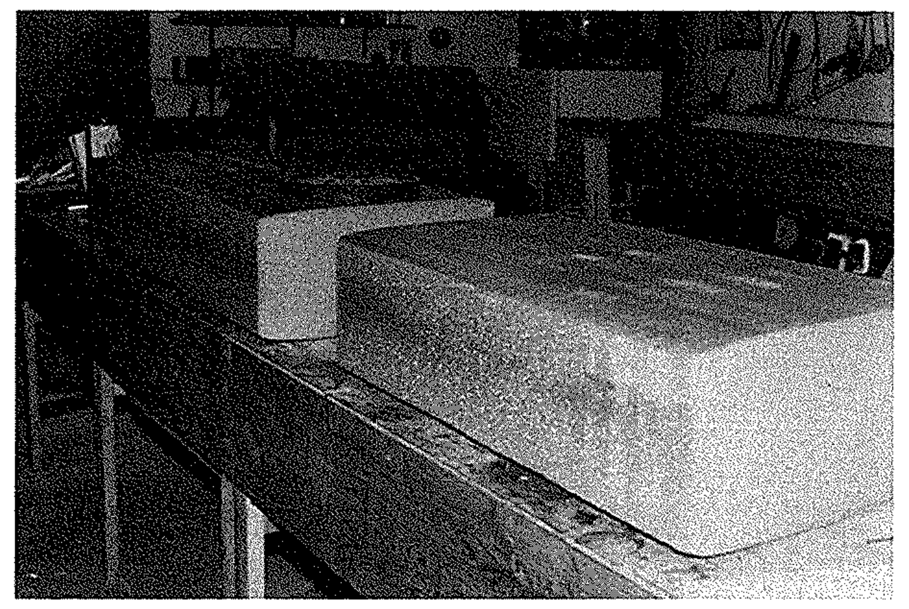
40. Spar caps are cured, trimmed and peel ply removed.



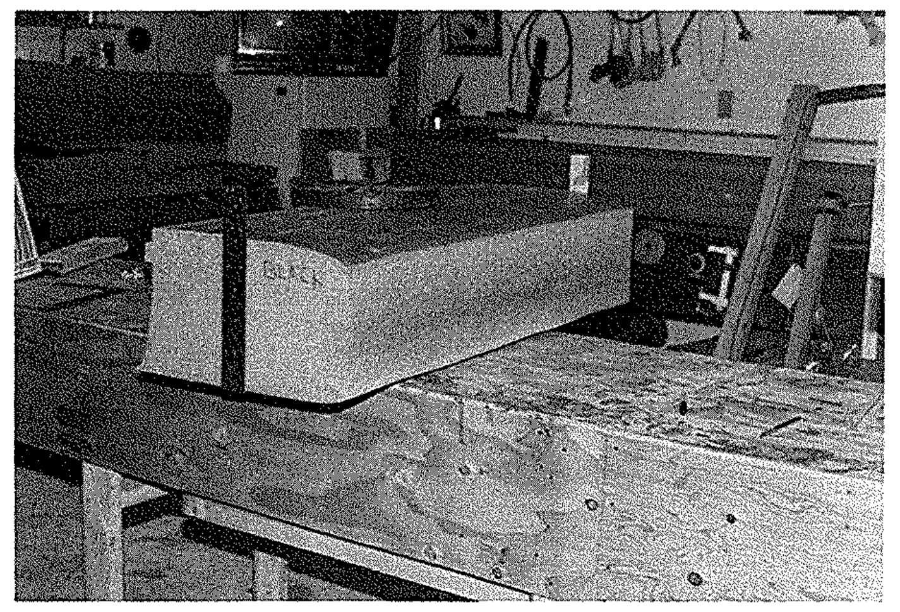
41. Do layup ③. 4 plies UND ± 45° on FORWARD FACE. NOTE: Again using peel ply.



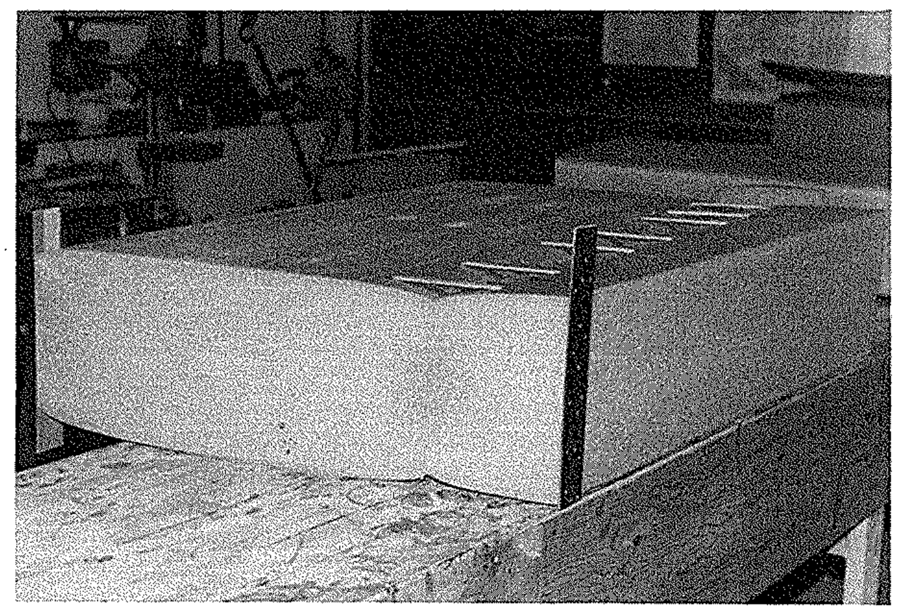
42. Here is where this "hummer" (centersection spar) goes. Also this is another method to positioning fuselage for installing landing gear.



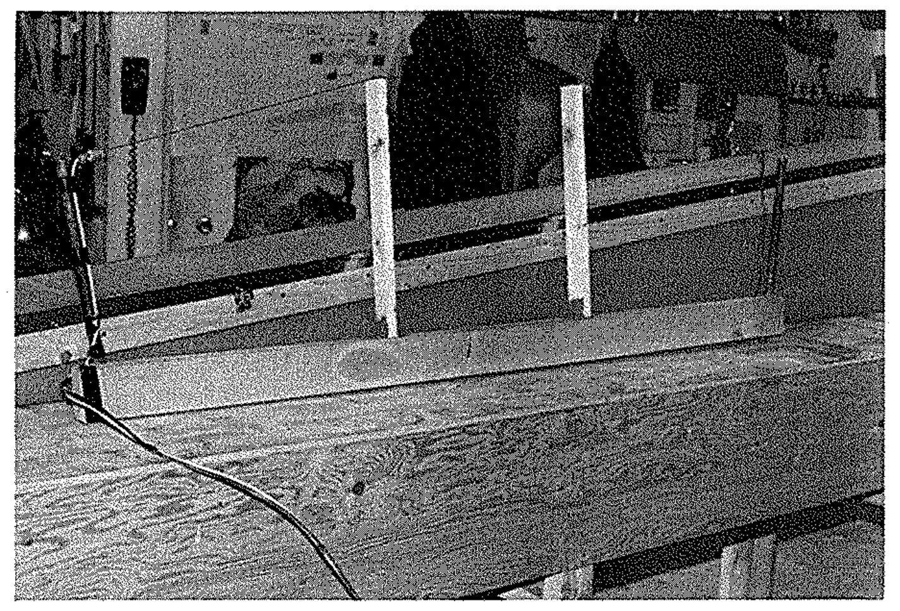
43. 2lb/ft$_3$ stryofoam blocks (light blue) which have been trimmed and squared.



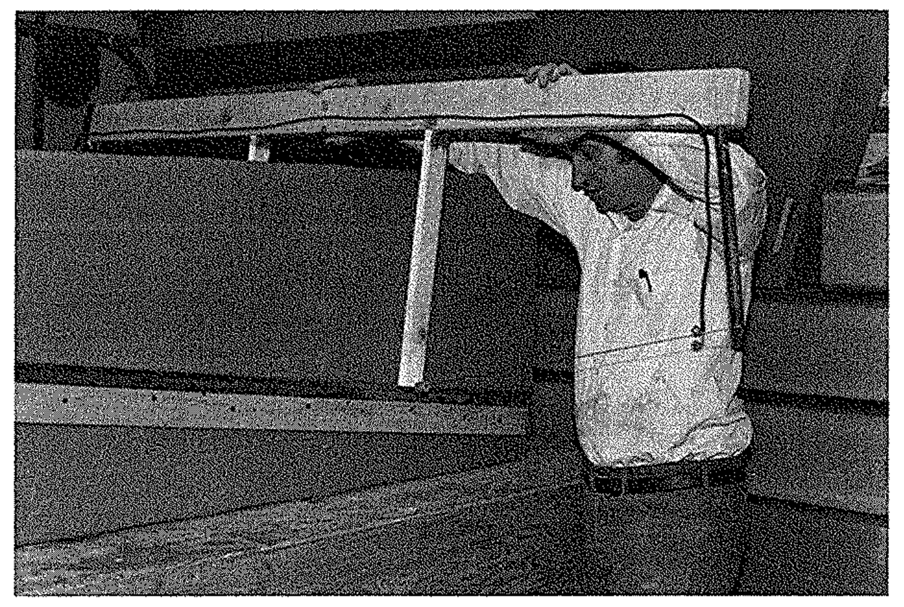
44. USING WOOD "straight edges" to make foam slice. FC-10A and FC-1A cut in Black block is being made.



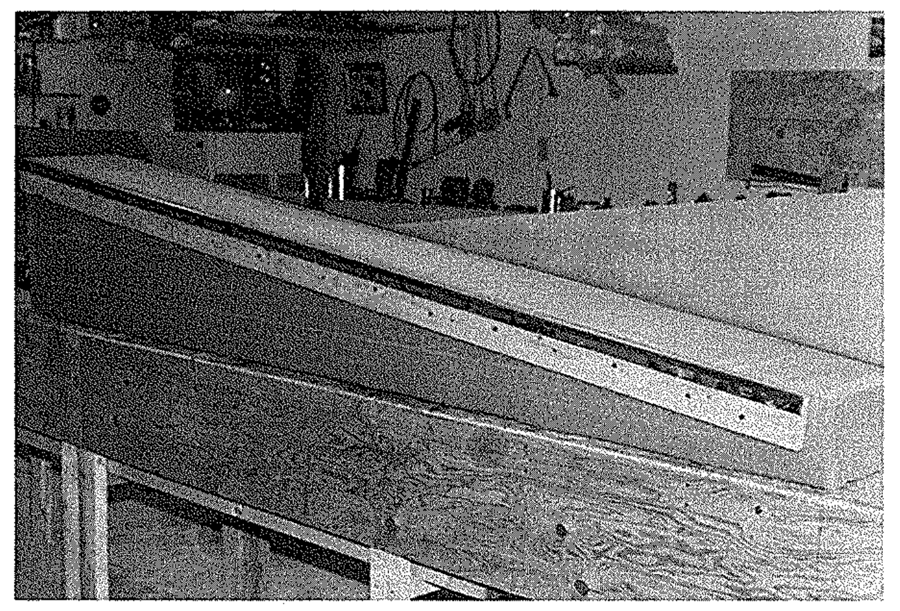
45. Again the straight edges - here we are matching angle of FC-1 to FC-1A.



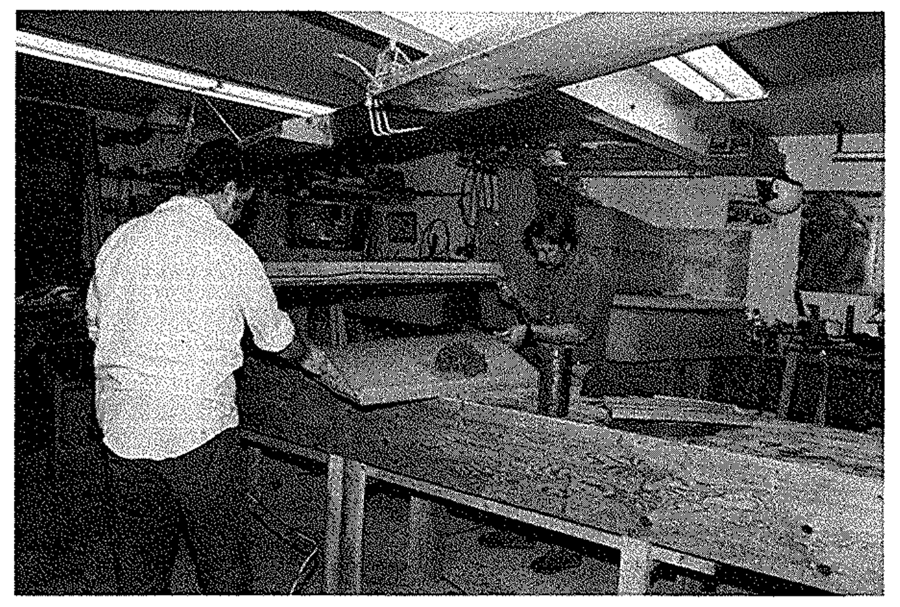
46. Modify hotwire saw to make long cut in Green block (SEE D-20).



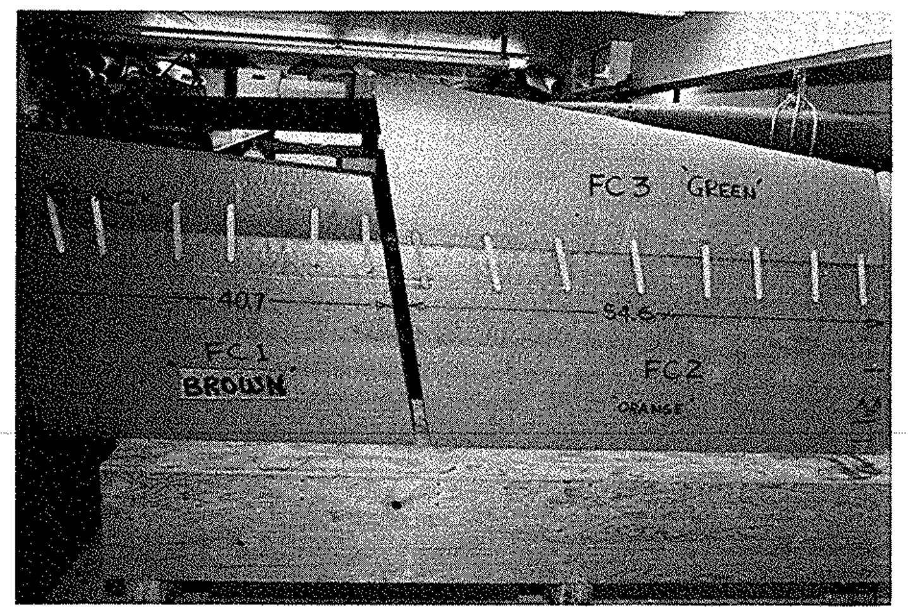
47. Making long cut in Green block - NOTE use of 2 EACH 8" long straight edges. (SEE D-20).



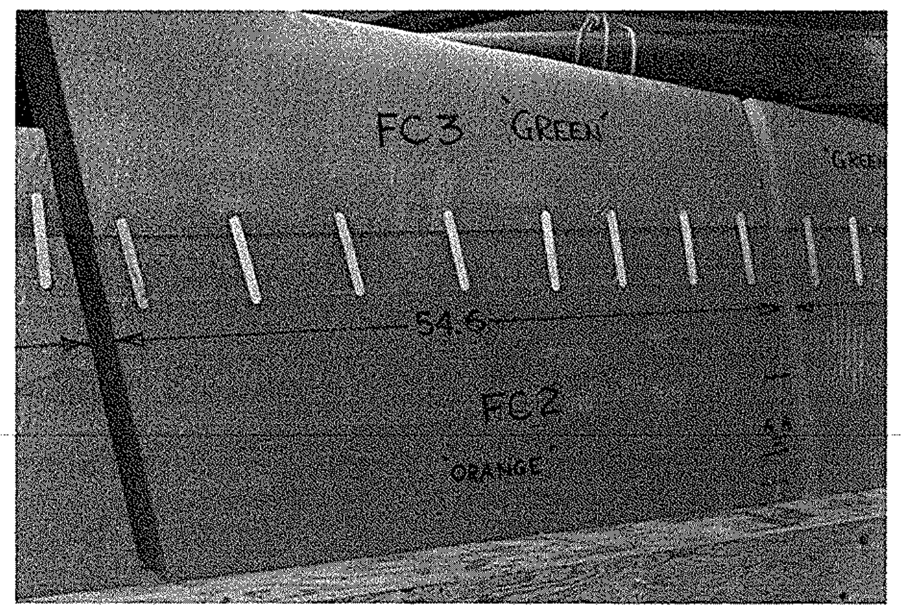
48. Finished long cut - makes FC-14, FC-12, FC-3 and FC-5.



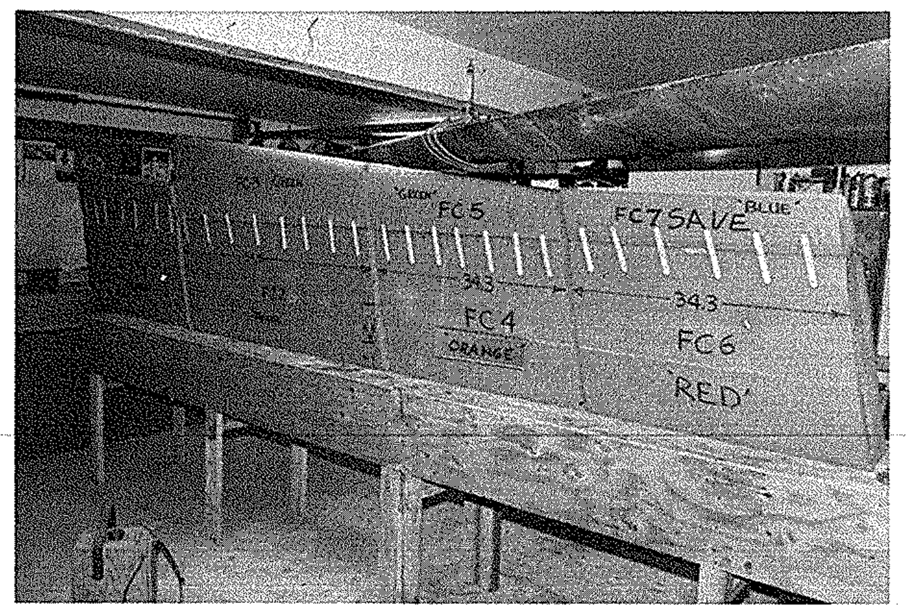
49. Showing typical two person operation to do hot wire cuts. BE CAREFUL, RELAXED AND RESTED before doing cuts.



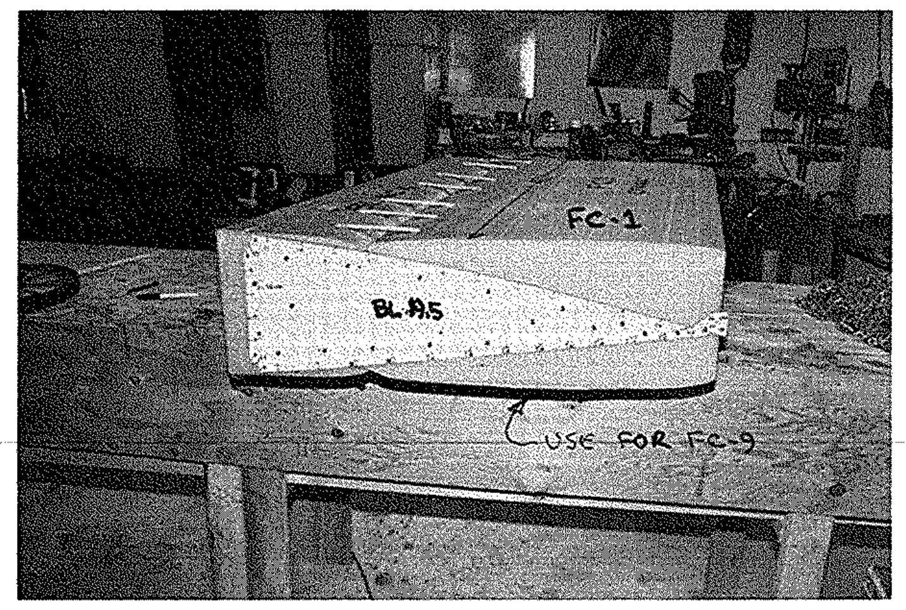
50. Right Wing. Foam blocks trimmed and angle cut to size. Blocks are temporarily held together with tongue despressors with 5 minute epoxy on each end.



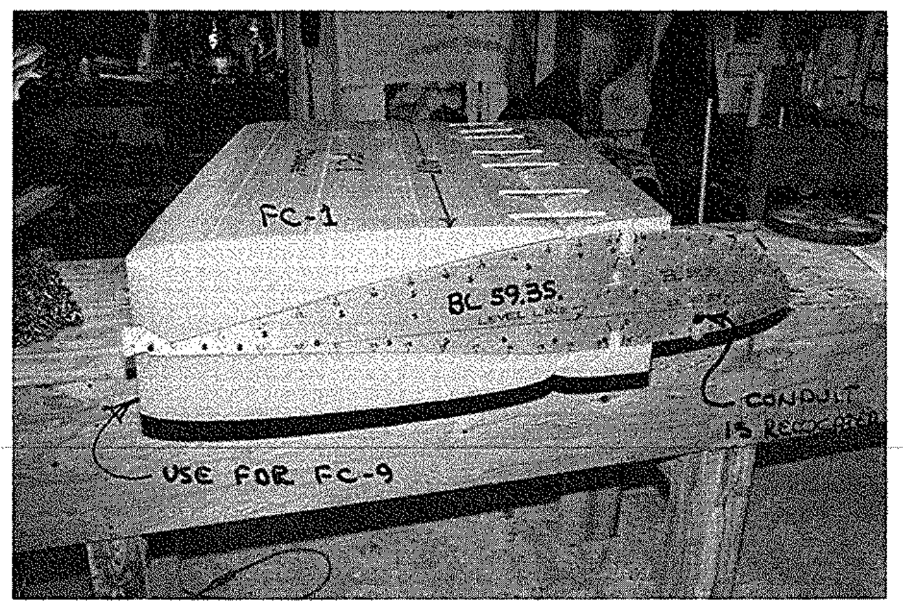
51. Right Wing. It is very important NOT to allow 5 minute epoxy to run down between blocks thus obstructing hot wiring.



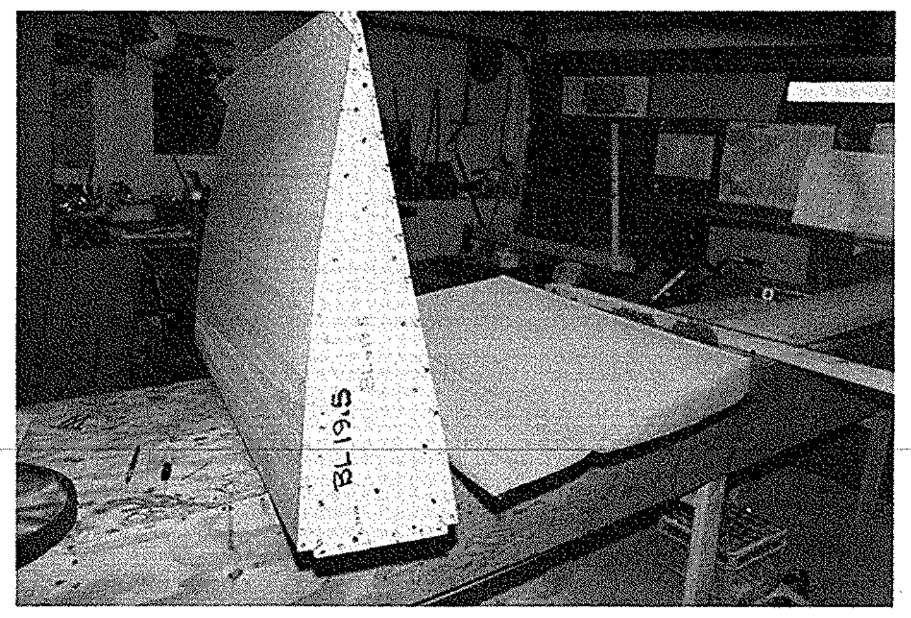
52. Right Wing. Study cores, drawings and photos carefully for full understanding of hot wire procedure before starting.



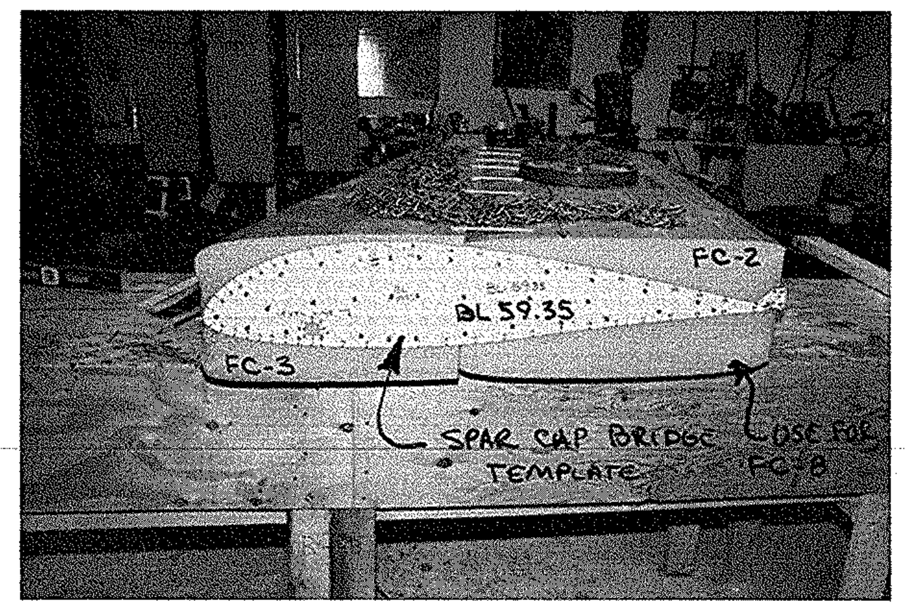
53. Right Wing. Set up hot wire templates level with each other. Use level and level line on template to accomplish B.L.19.5 to B.L. 59.35



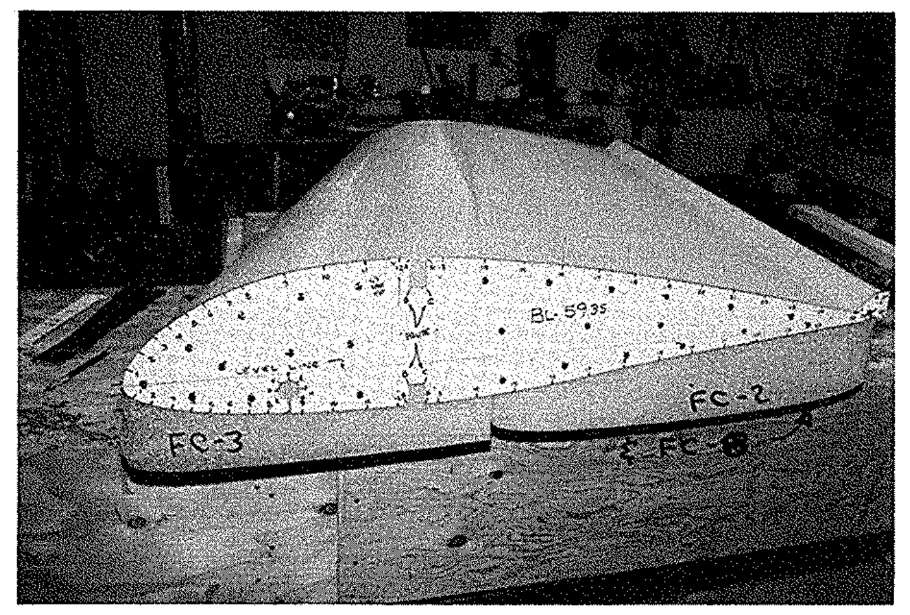
54. Right Wing. NOTE: The electrical conduit hole to wing tip has been relocated to aft of spar. Photo is opposite end of Photo #53.



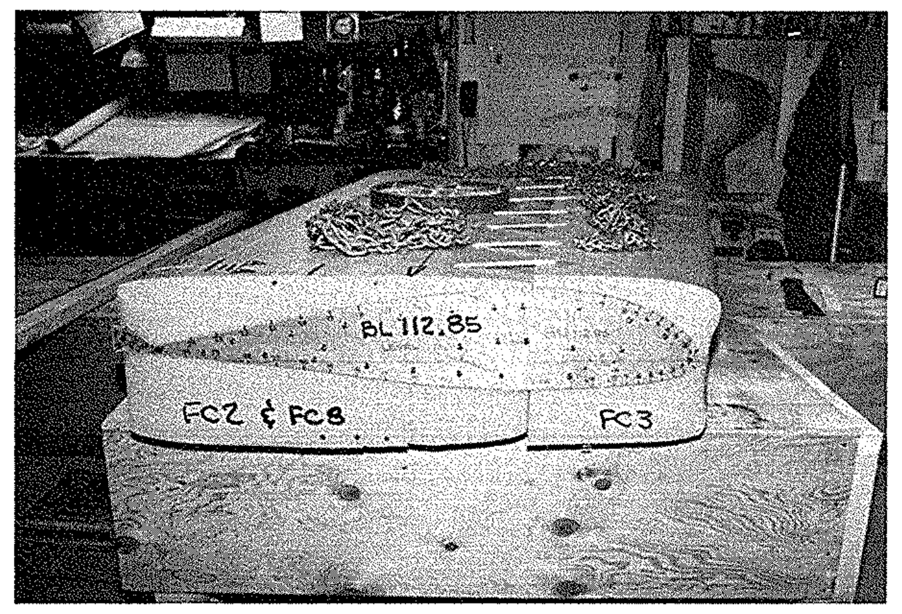
55. Right Wing. What your core will look like after cut. B.L. 19.5 to B.L. 59.35.



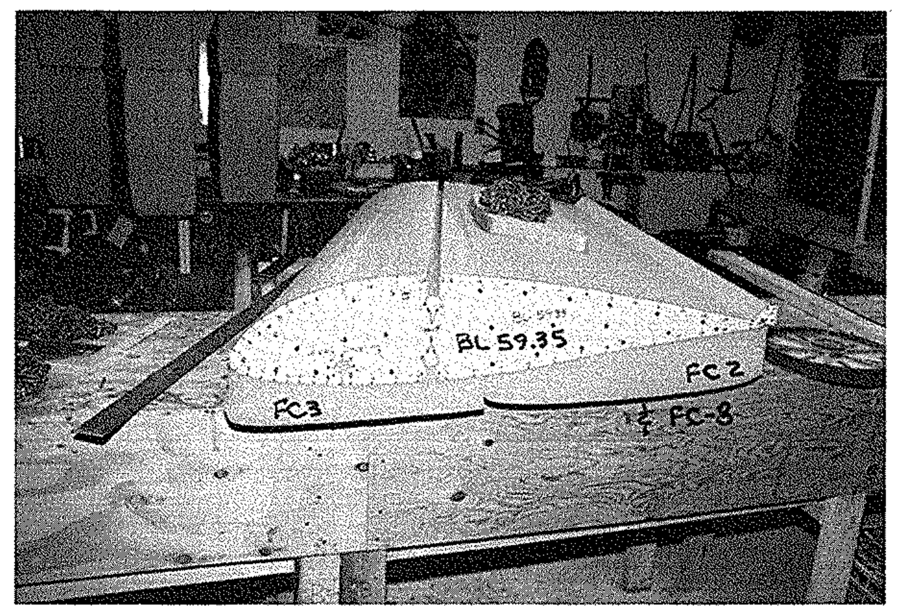
56. Right Wing. The use of chains, lead shot and weights of this nature work well to hold foam in place while hot wiring. Note use of spar cap bridge template. B.L. 59.35 to B.L. 112.85.



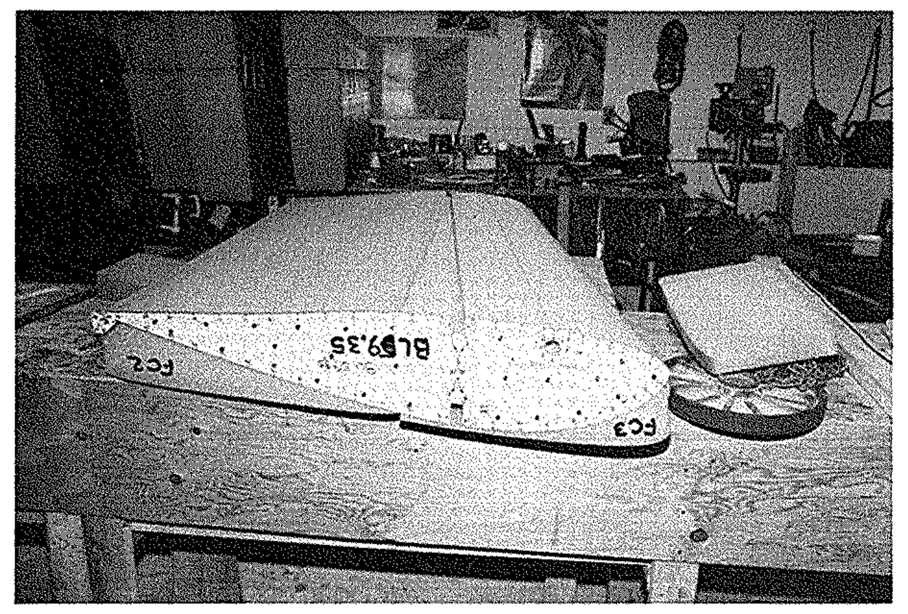
57. Right Wing. Portion of FC-2 is used for FC-8 (winglet). After cutting airfoil shape remove spar cap bridge template to cut spar cap trough. (SEE Photo 59). B.L. 59-35 to B.L. 112.85



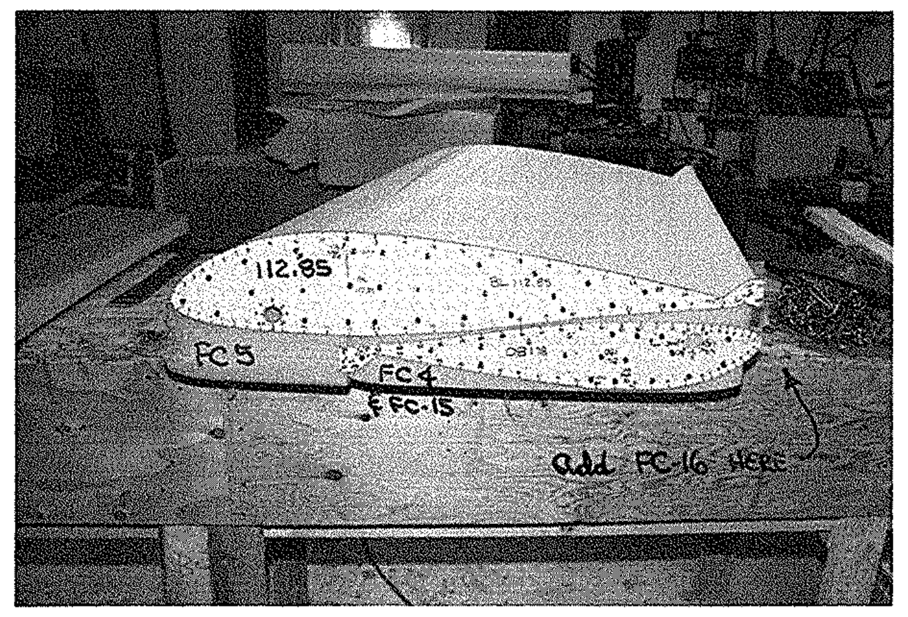
58. Right Wing. Opposite end of Photo #57 before hot were cut and with bridge template in place. B.L. 112.85 back to B.L. 59.35



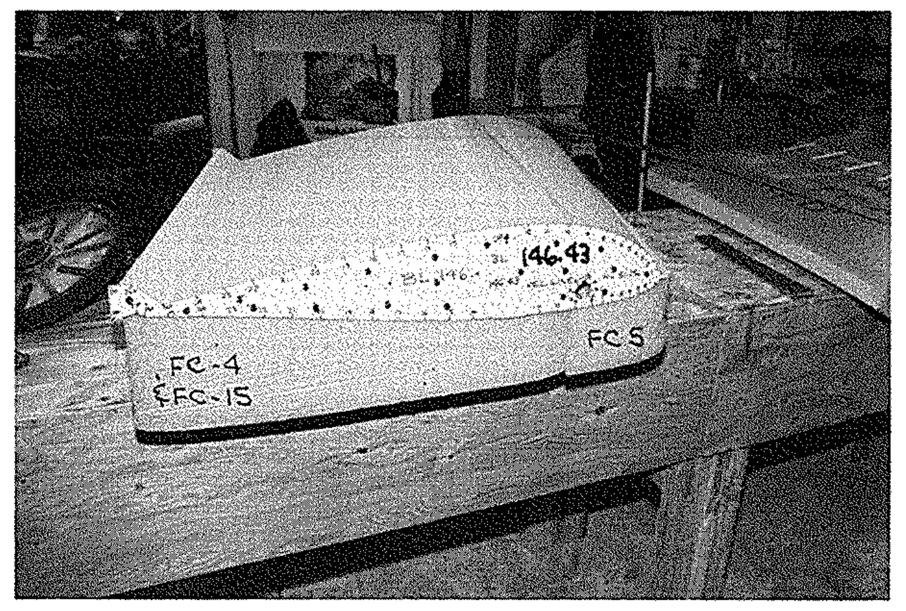
59. Right Wing. After cutting top spar cap trough. Note part of FC-2 is used for FC-8. B.L.59.35 to B.L.112.85



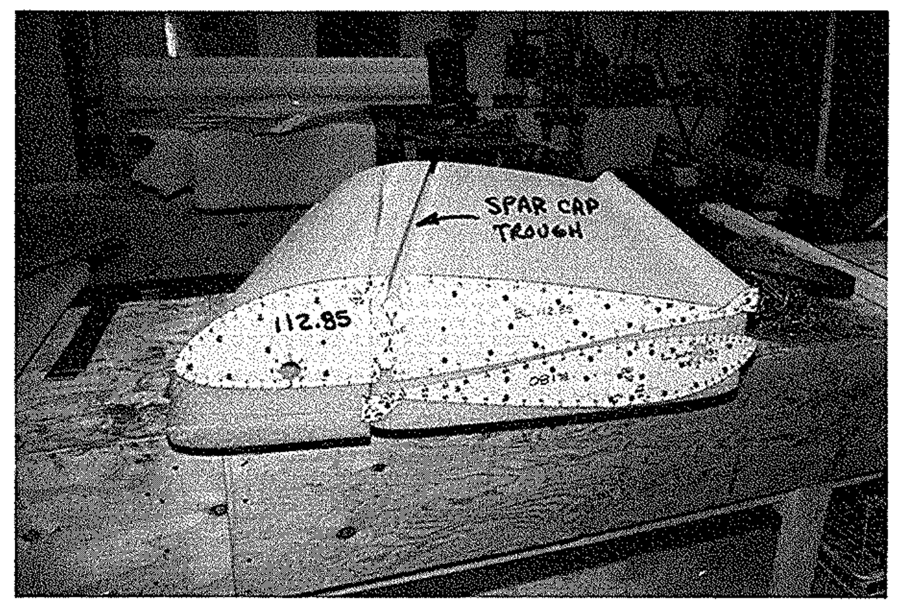
60. Right Wing. Bottom spar cap.



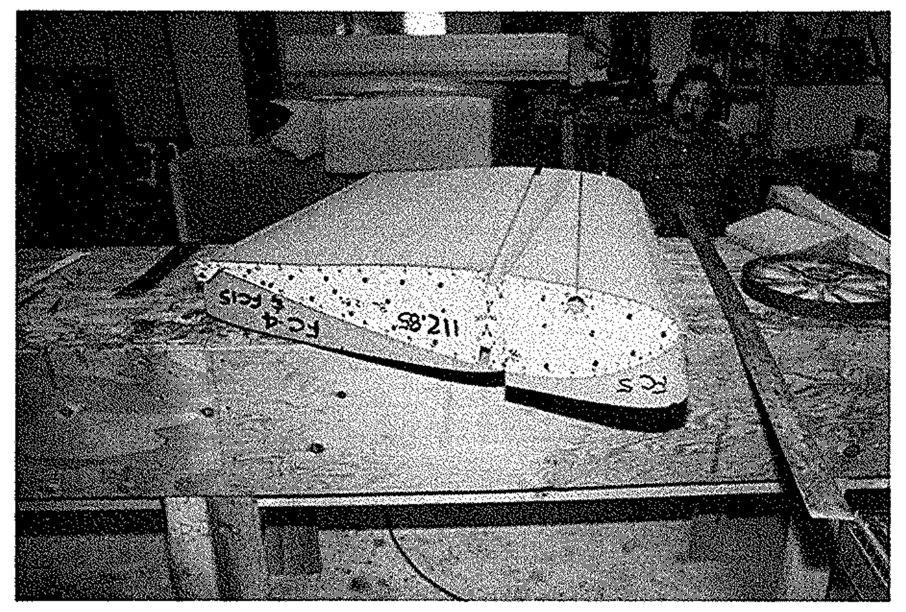
61. Right Wing - B.L. 112.85 to 146.43
LEFT Wing - B.L.146.43 to 180



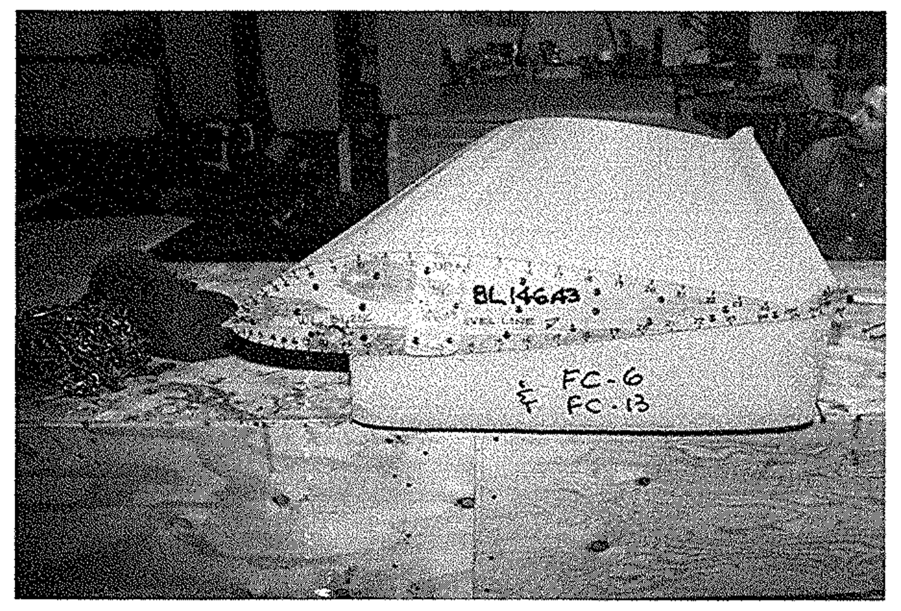
62. Right Wing. Opposite end of Photo #61. B.L.146.43 template is simply repositioned for (left wing) B.L. 146 .43 to B.L.180. (SEE Photo #72)



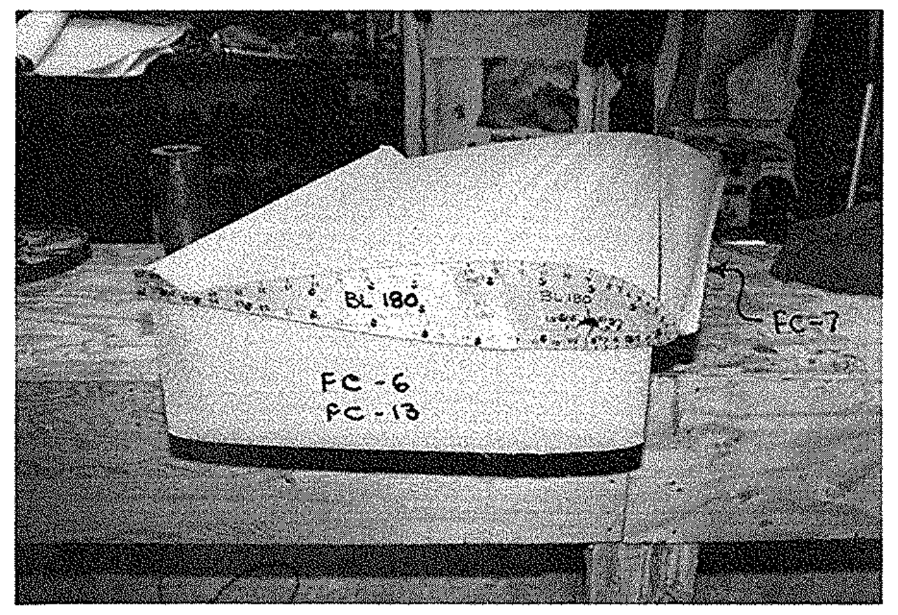
63. Same as Photo #61 except spar cap is cut.



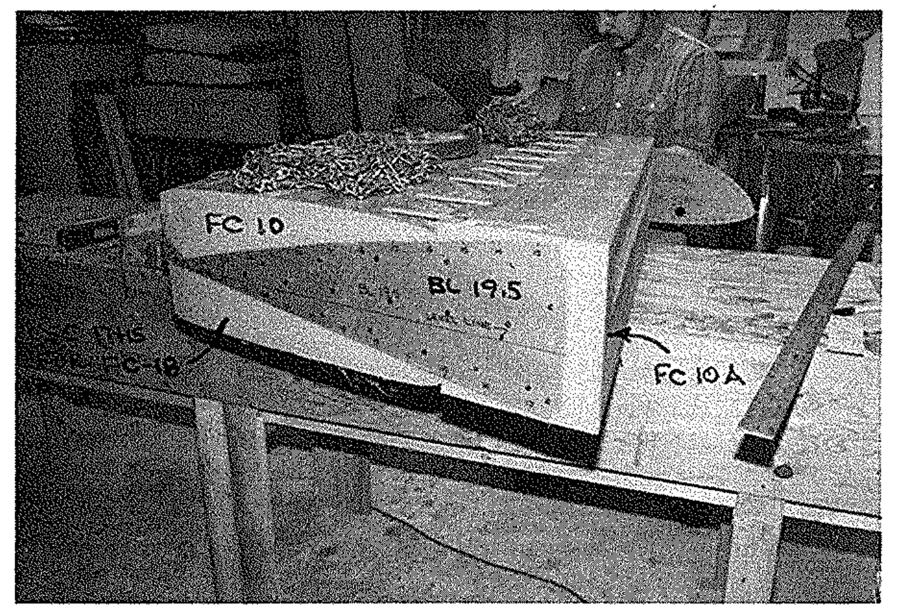
64. Right Wing. Bottom spar cap.



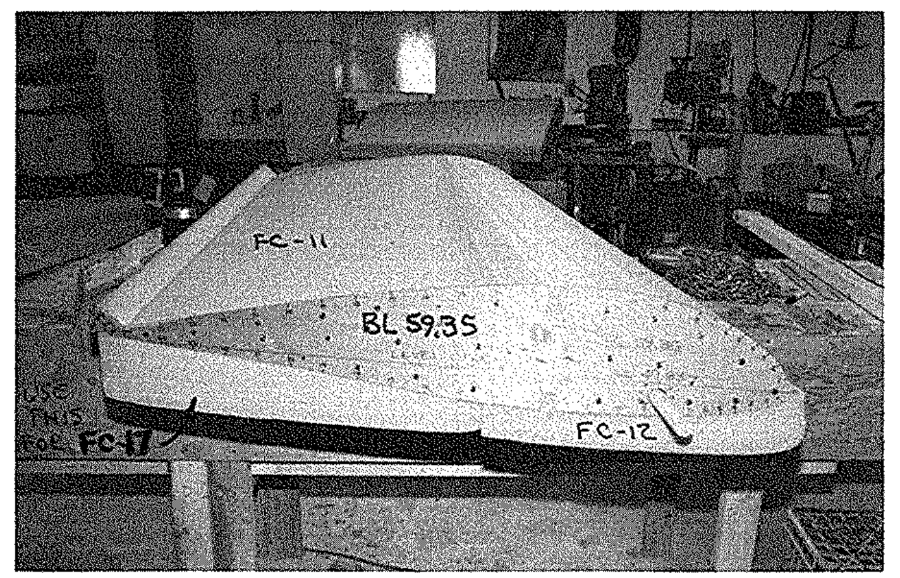
65. Right Wing. B.L. 146.43 to B.L. 180. NOTE: Bridge templates.



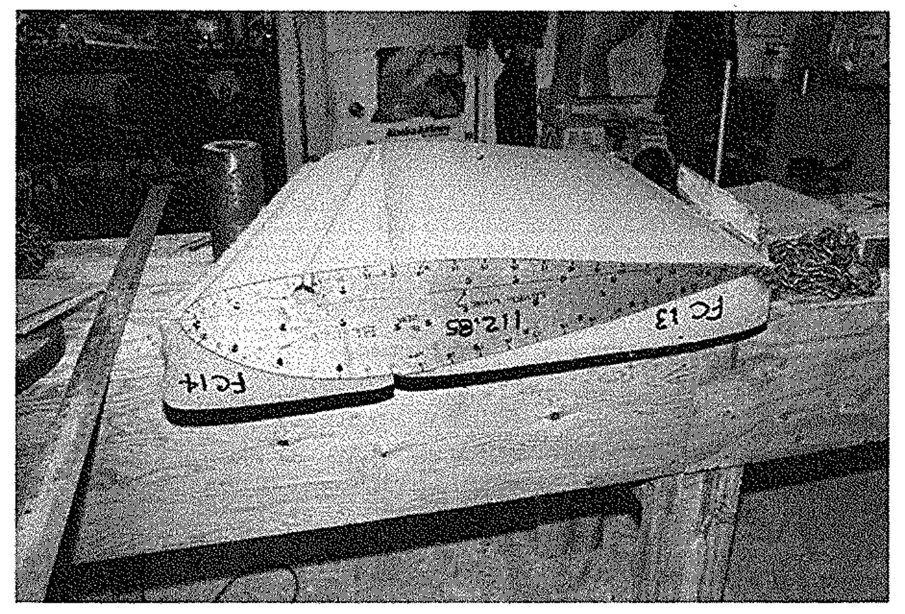
66. Right Wing. Opposite end of Photo #65.



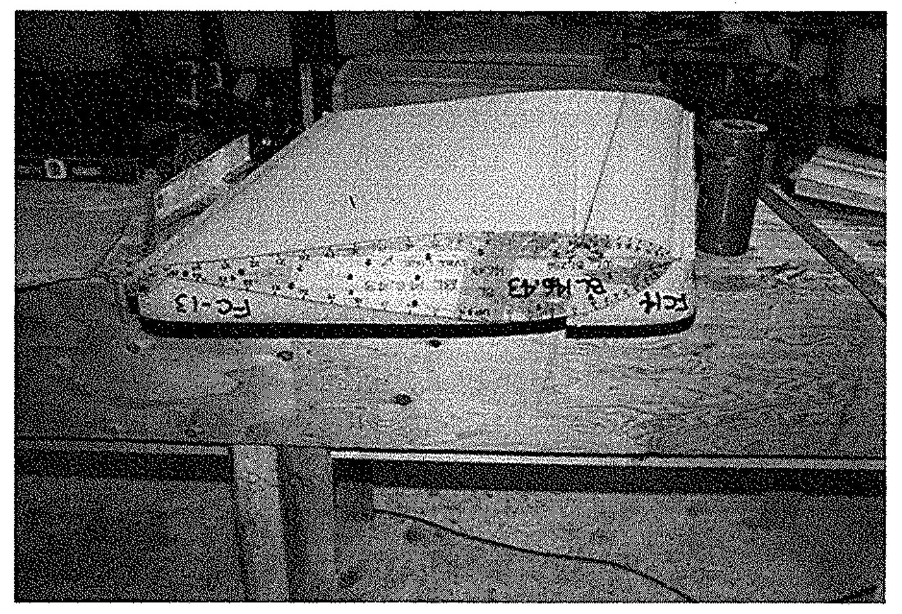
67. LEFT Wing. B.L.19.5 to B.L.59.35



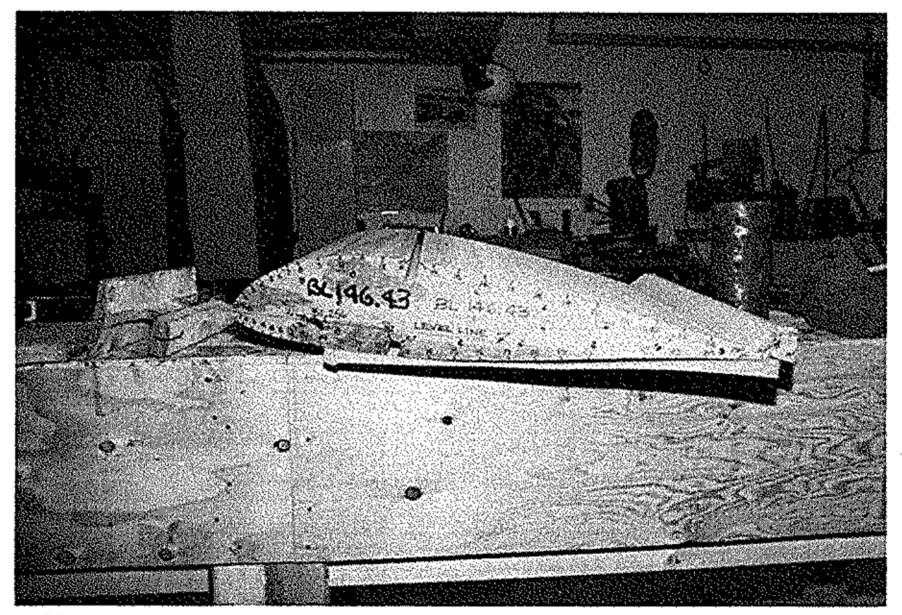
68. Left Wing. B.L. 59.35 to B.L. 112.85. NOTE: Electrical conduit (see foam core extending out) has been relocated to aft side of spar for better wire routing and ease of maintenaince after completion of aircraft.



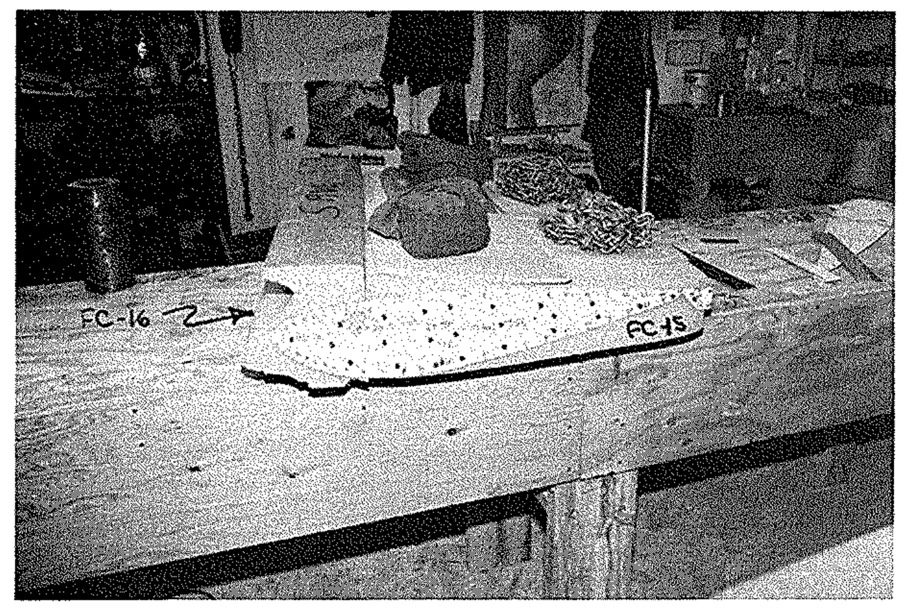
69. Left Wing. B.L. 112.85 to B.L. 146.43



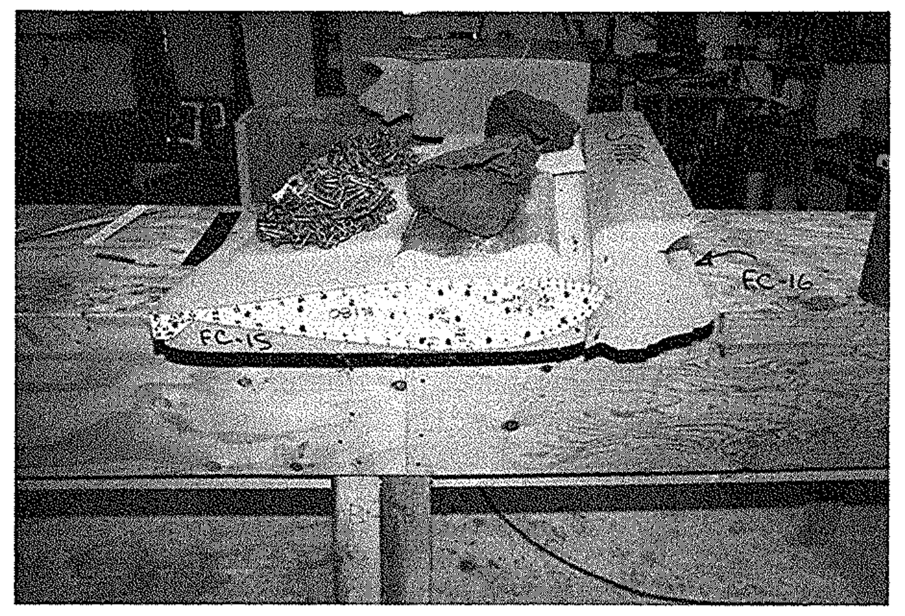
70. Left Wing. Opposite end of Photo #69.



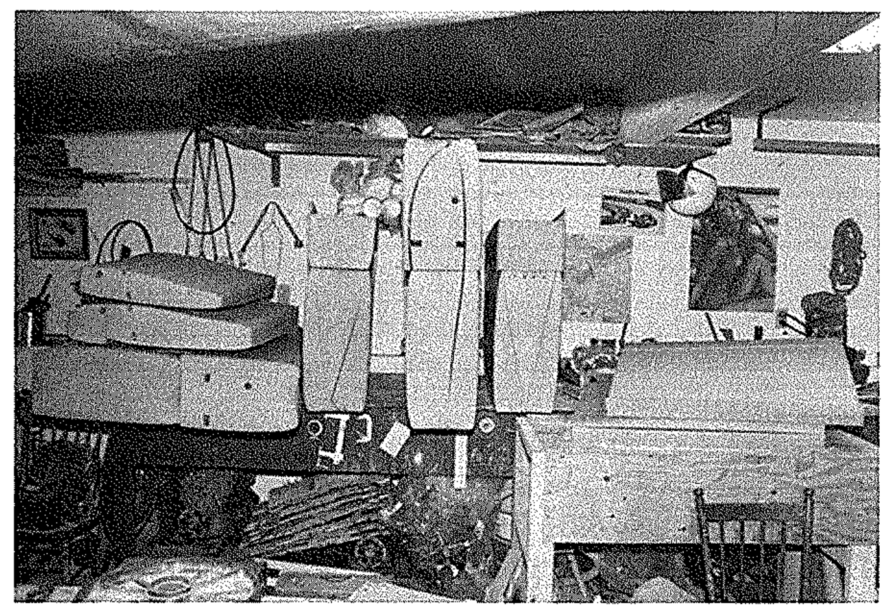
71. Left Wing. Top spar cap trough B.L. 112.85 to B.L. 146.43. NOTE: The careful need to arrange templates on foam to insure enough foam for all cores.



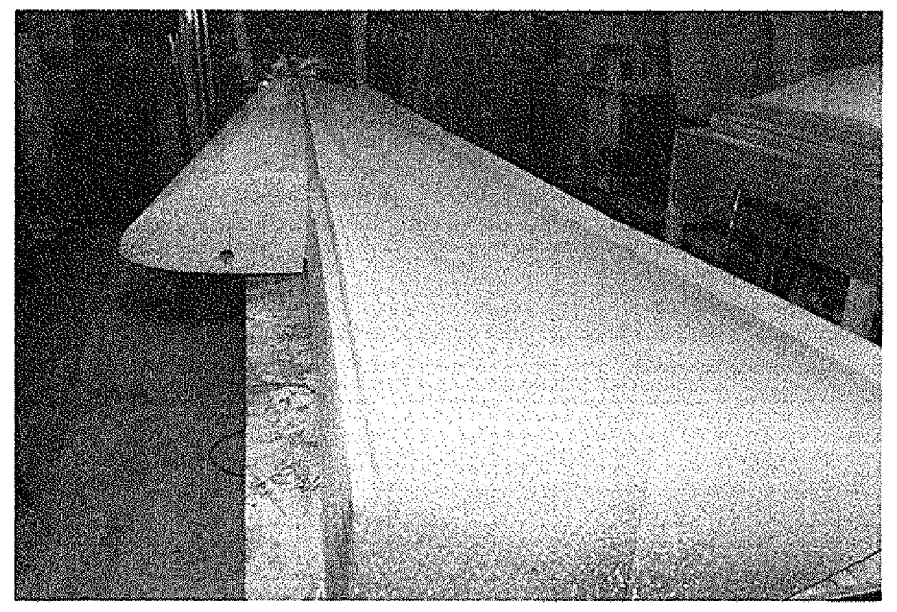
72. Left Wing. B.L. 146.43 to B.L. 180



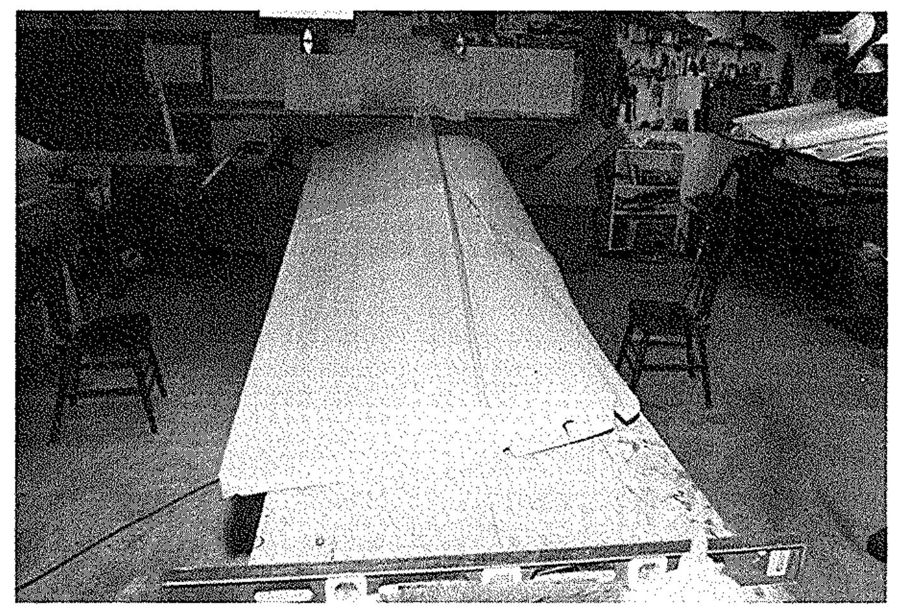
73. Left Wing. Opposite end of Photo #72. Note - adding FC-16 (Blue Block).



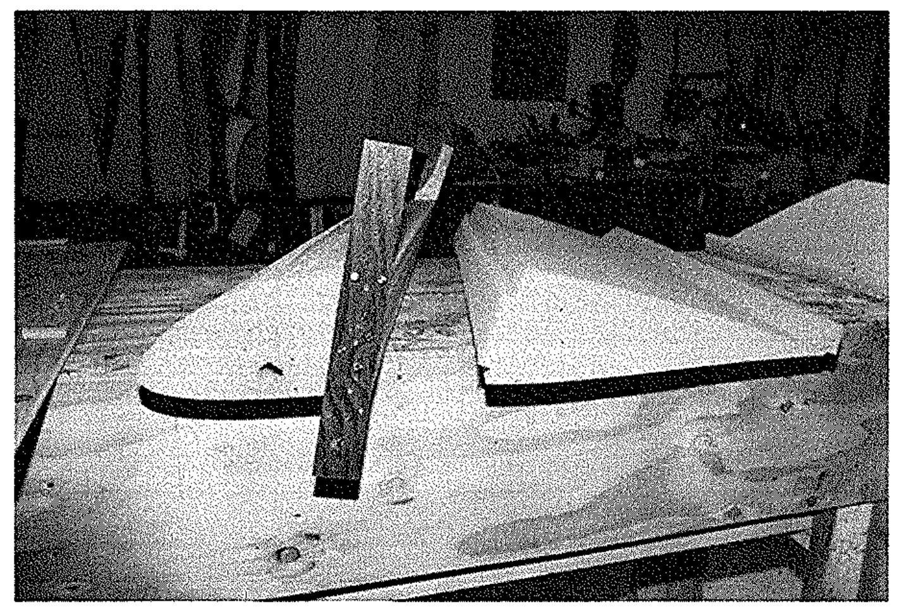
74. Storing foam core while building wings.



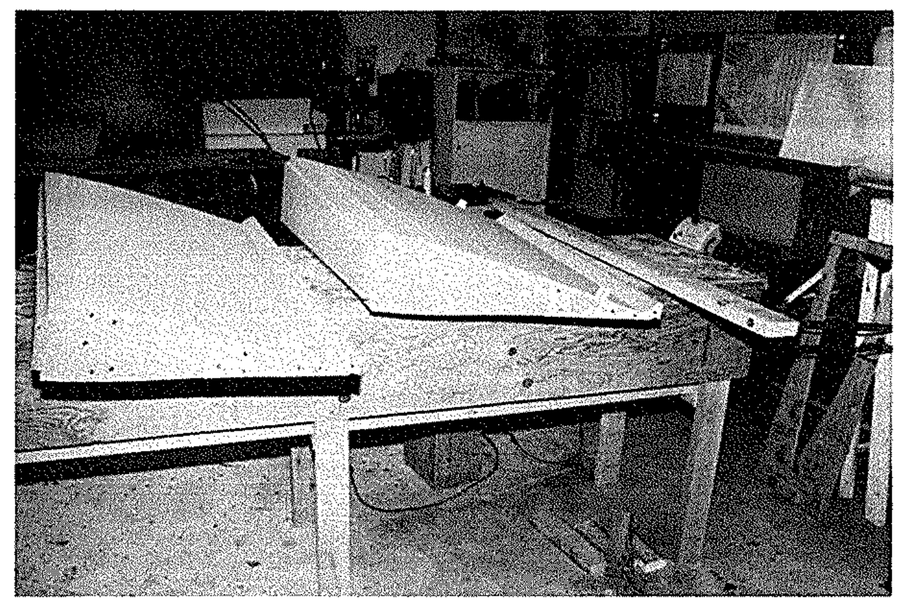
75. RIGHT Wing. Top side of right wing. From B.L.19.5 to tip of B.L. 180.



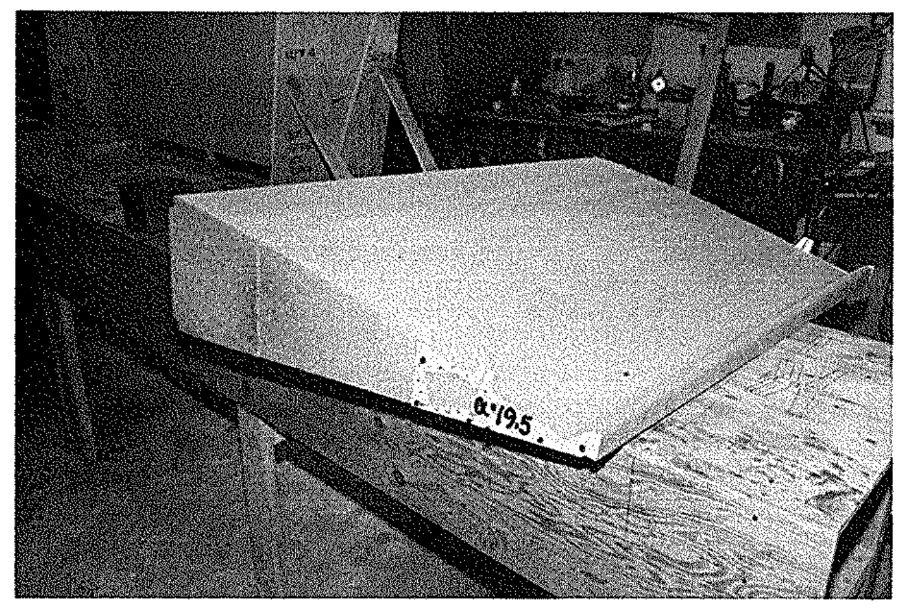
76. Right Wing. Top side of all cores, right wing. From B.L. 180 to root B.L. 19.5.



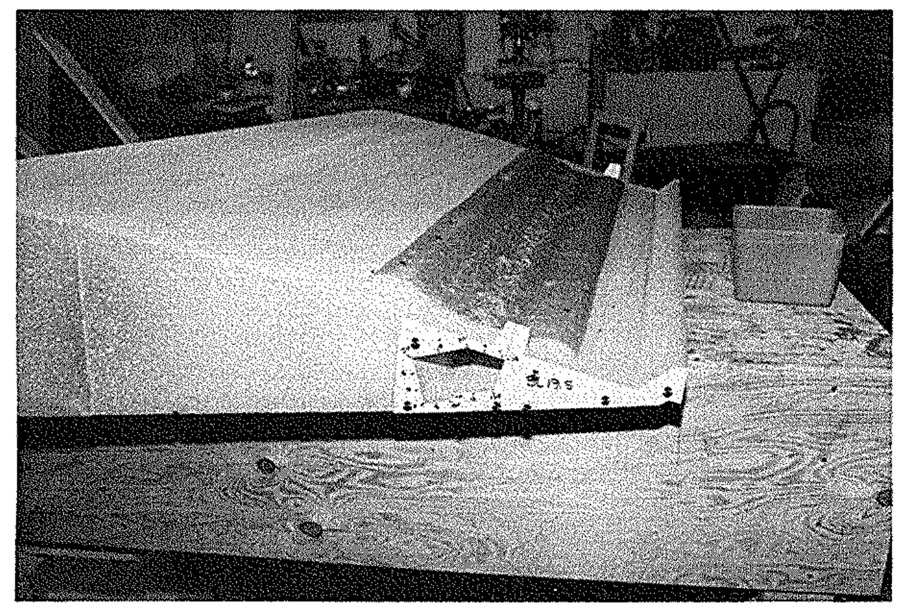
77. Using "straight edges", hot wire cores apart at spar cap to ready for shear web layups. (SEE D-31).



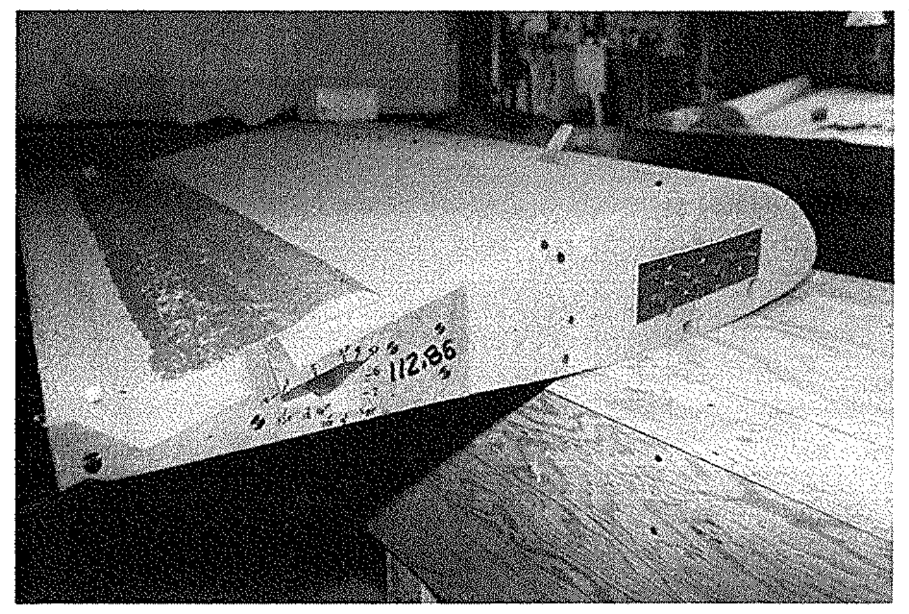
78. Using aileron templates (SEE D-2) cut out area in foam core for aileron.



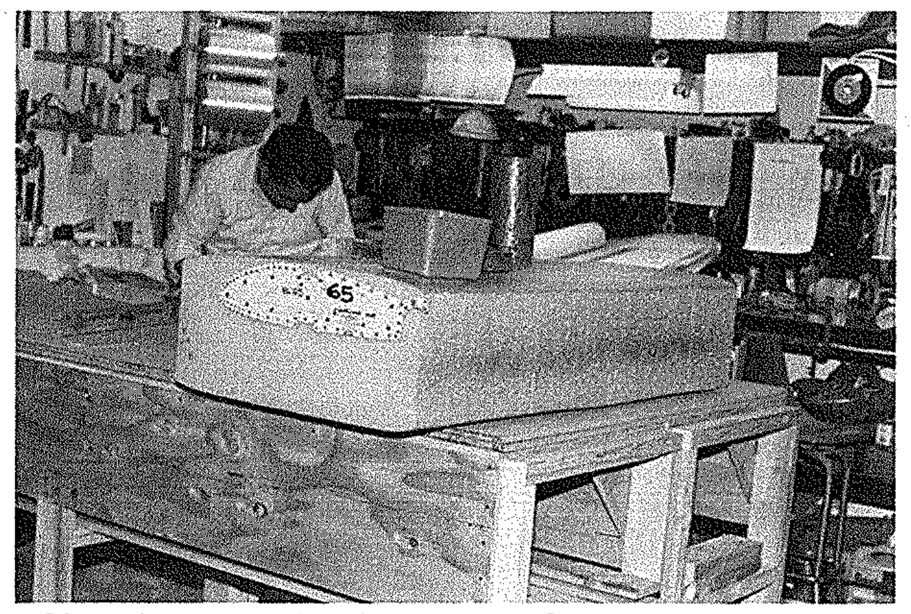
79. RIGHT Wing. B.L. 19.5 to B.L. 59.35



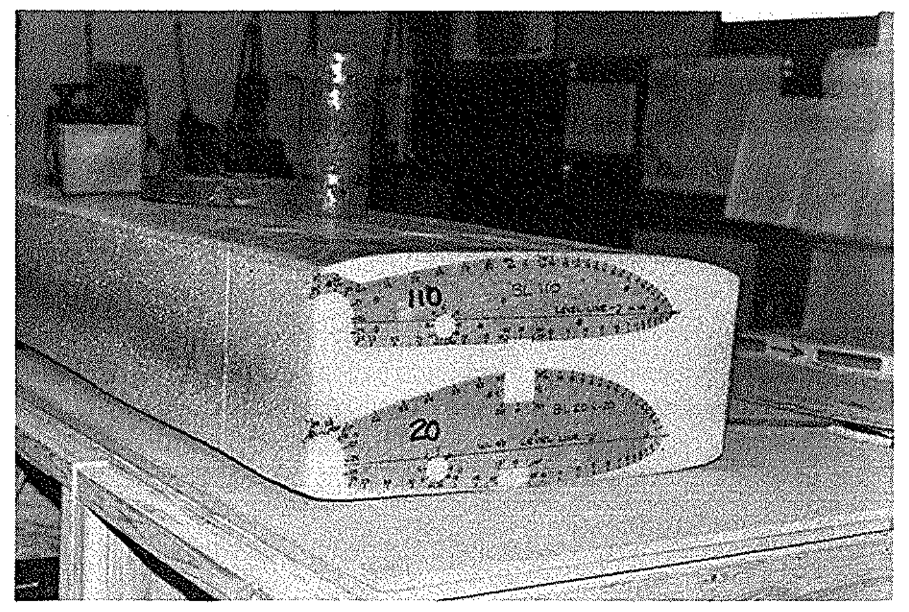
80. Right Wing. Use scrap foam material and nails to hold trailing edge in place after cut what will become the aileron hinge line.



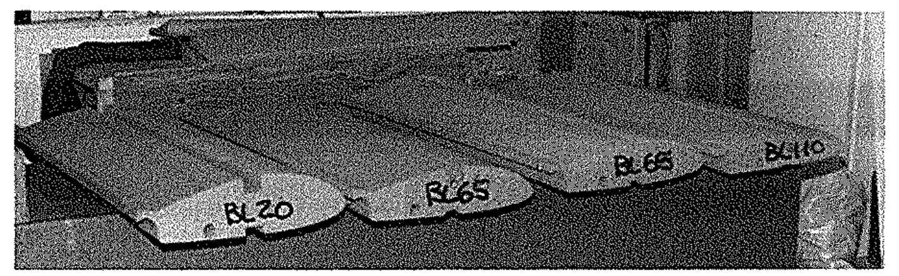
81. Right Wing. End of aileron at B.L.112.85.



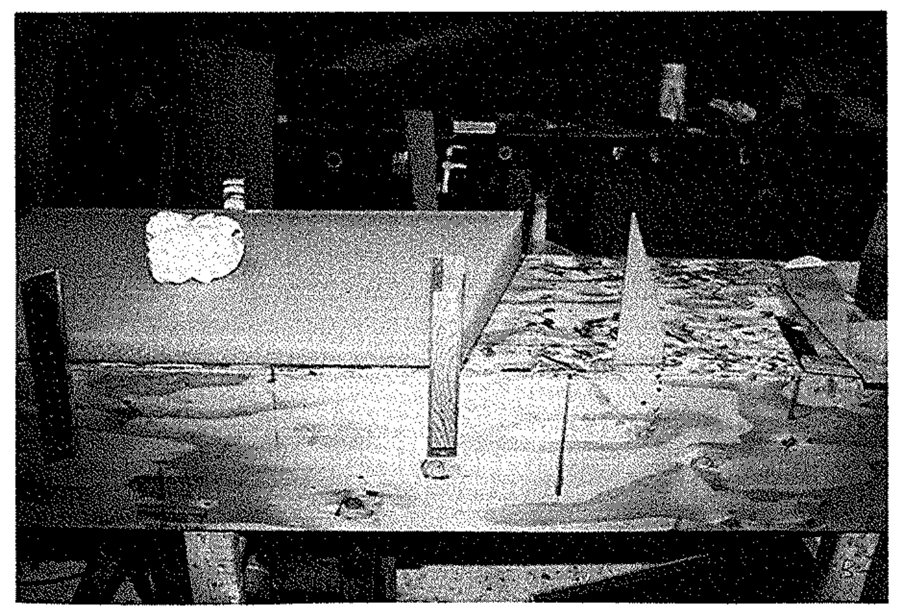
82. Canard. Setting up templates to cut canard foam cores BL +65 to B.L. +110. (SEE D-20).



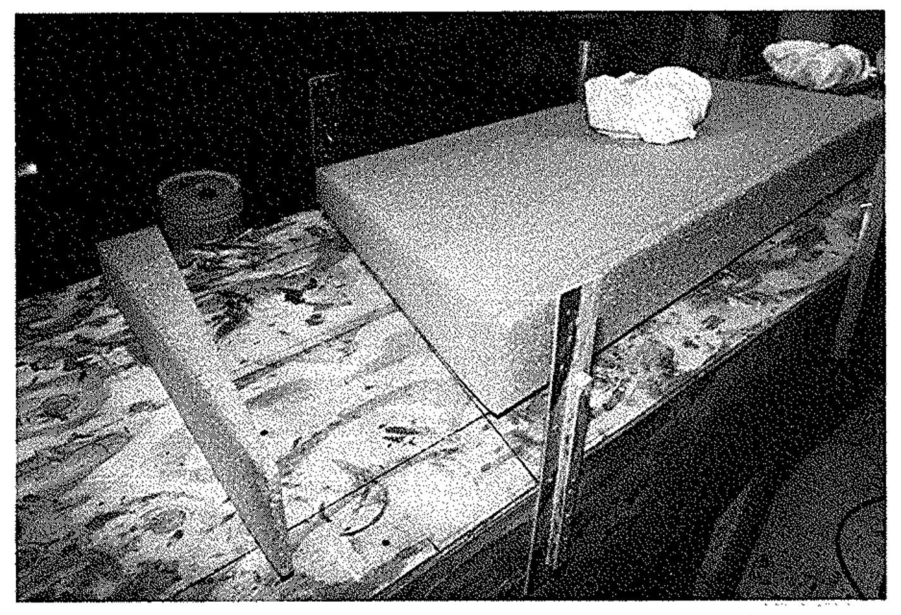
83. Canard. Opposite end of Photo #82.



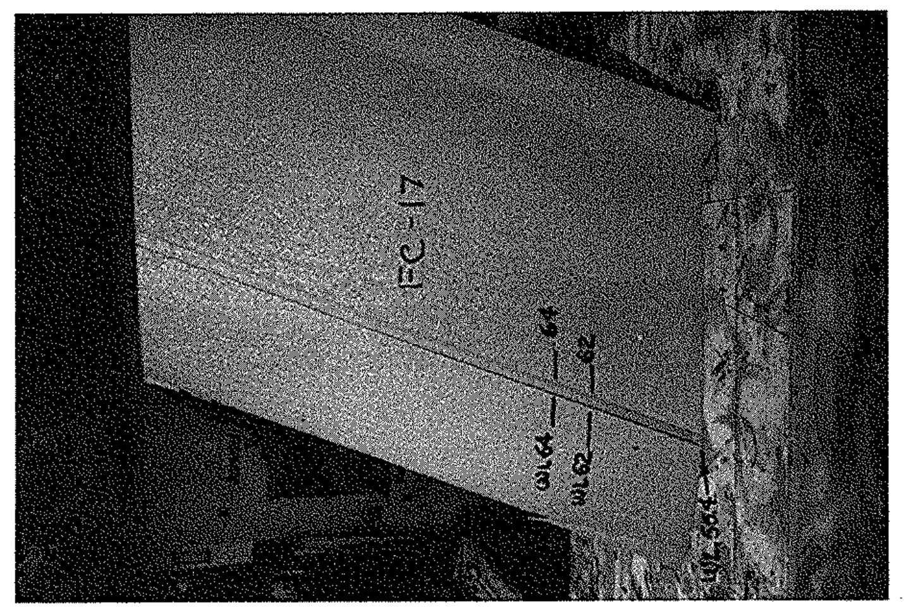
84. Canard. Four of seven canard foam cores. (SEE photo C-4 for additional cores.).



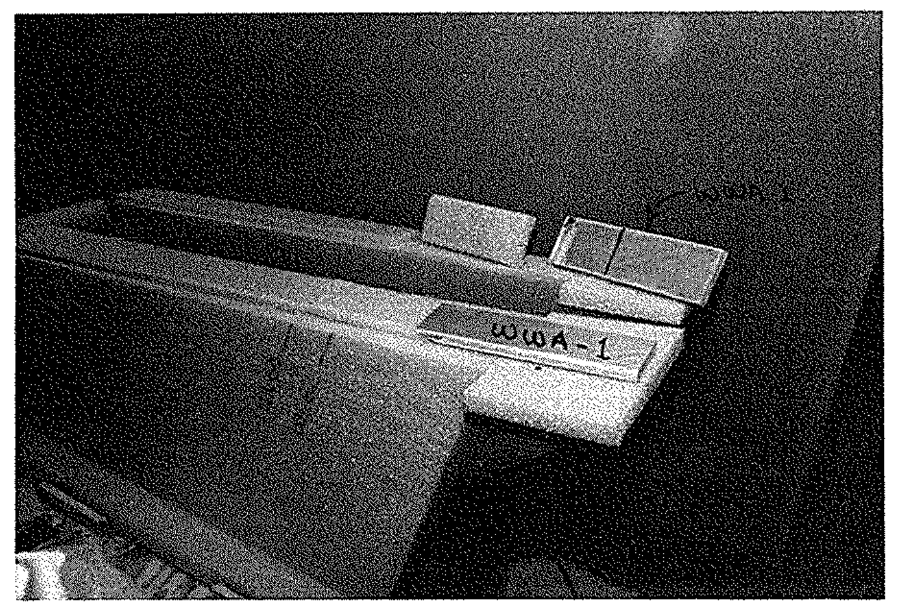
85. Winglets. Making foam core angle cuts for winglets. (SEE D-20)



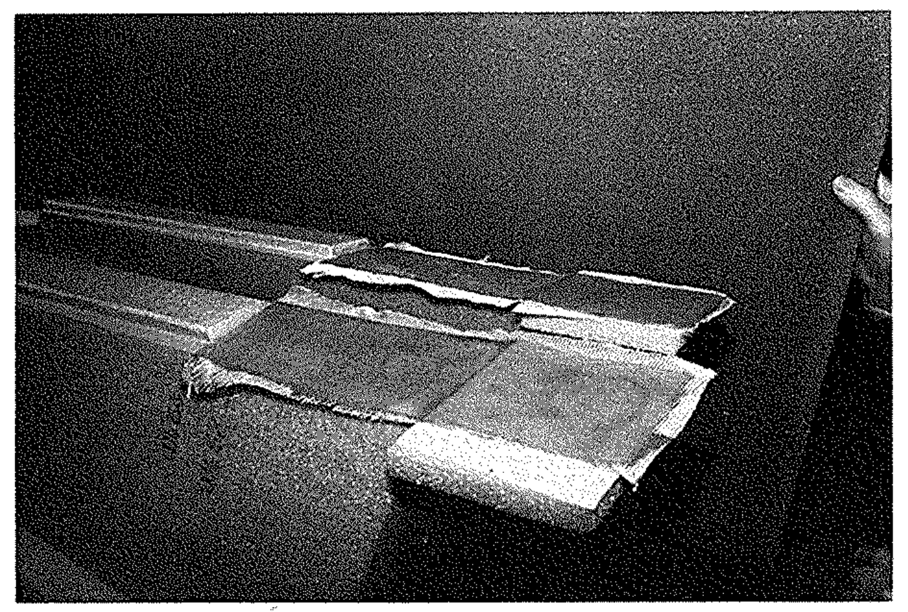
86. Winglets. Use angle cut jig as described on D-20.



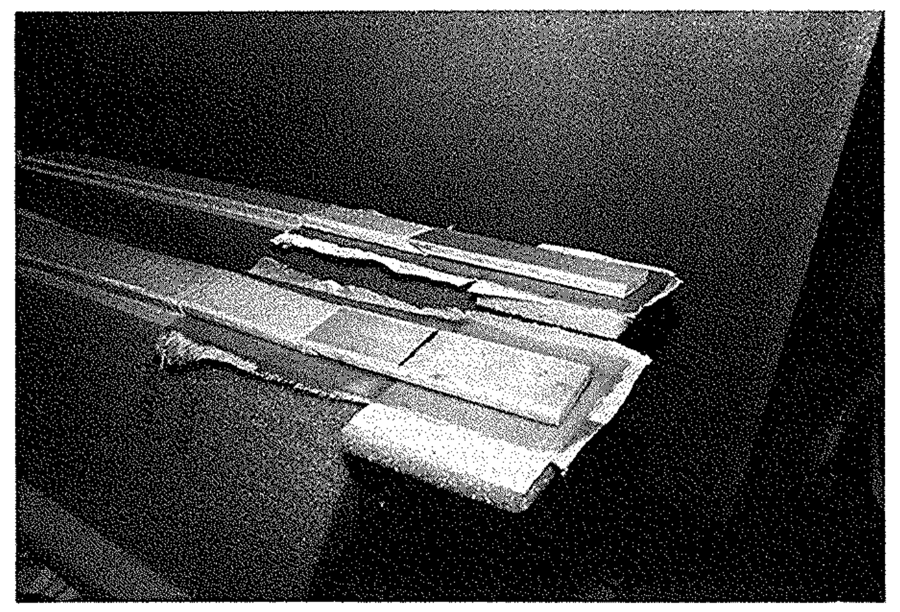
87. LEFT Winglet. Outboard side of lower foam core.



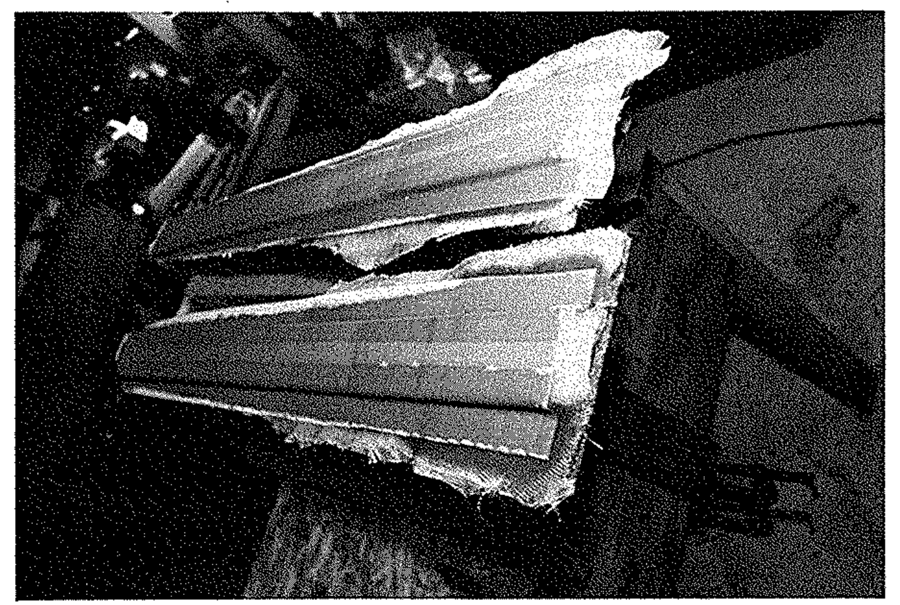
88. Winglets. Cut lower foam cores FC-17 and FC-8 at shear web. Cores are being prepared for WWA-1 and shear web layups.



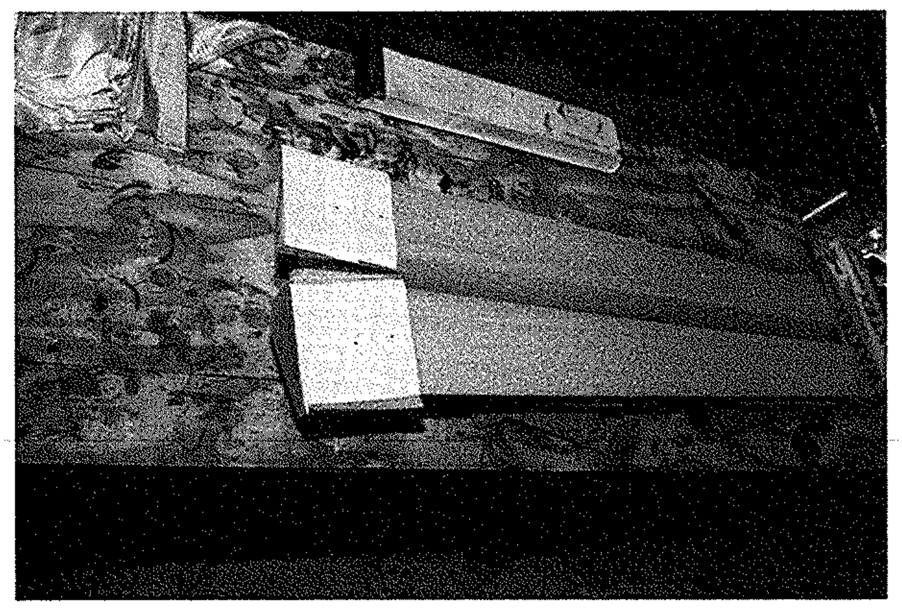
89. Winglets. Shear web layup ①.



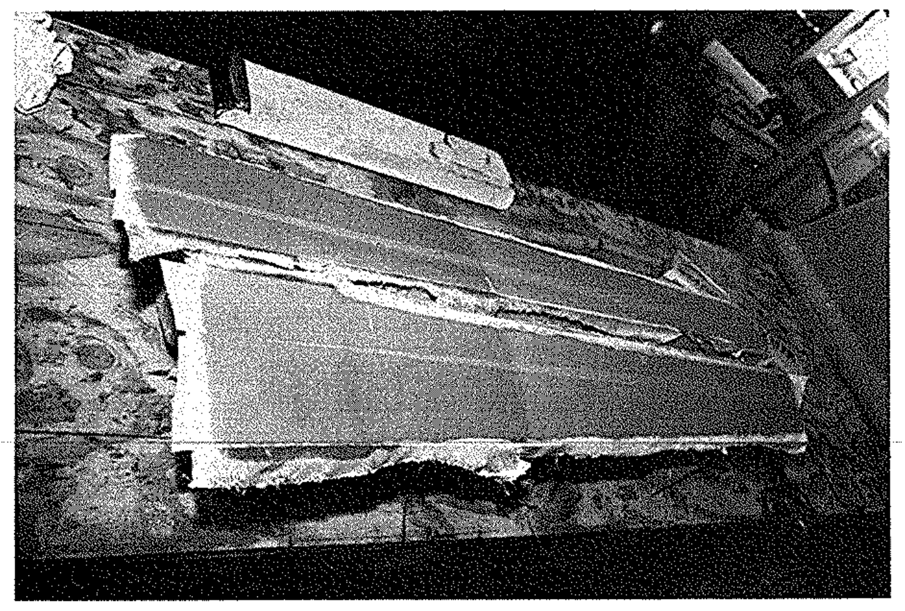
90. Winglets. Placing WWA-1 on layup ① - use wet flox.



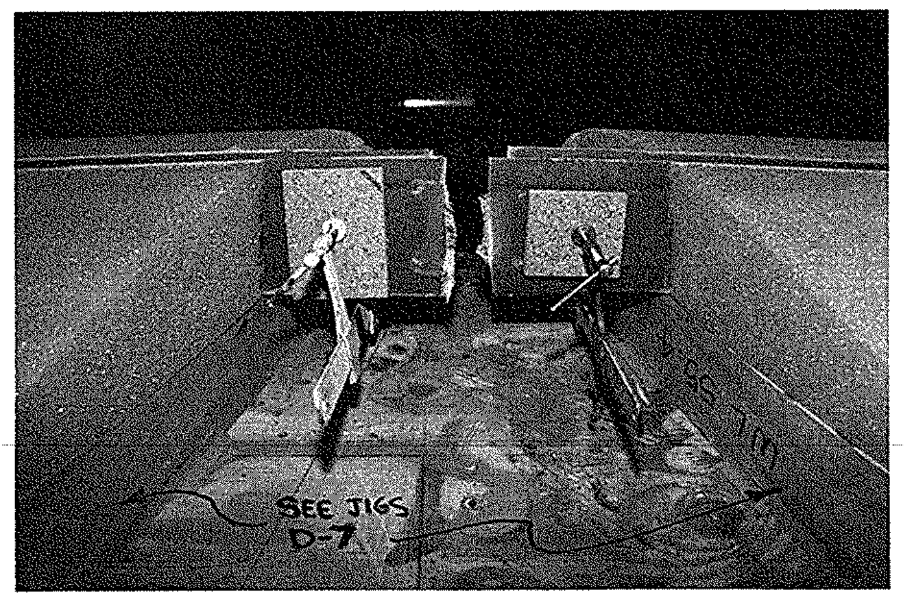
91. Winglets. Shear web layups ①, ② and ③. NOTE: PEEL PLY entire shear web surface.



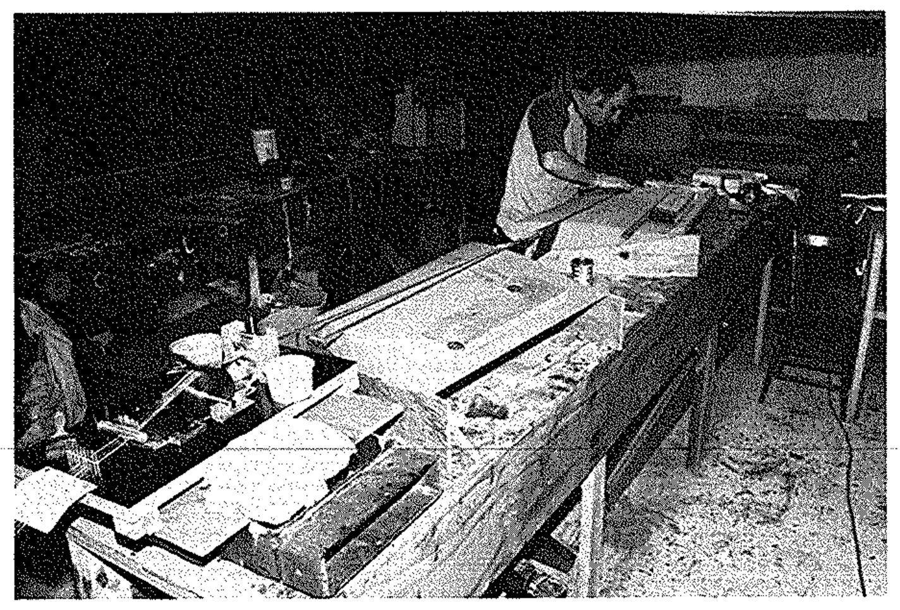
92. Winglets. Preparing surface for shear web layup ④ and ⑤. NOTE: PEEL PLY.



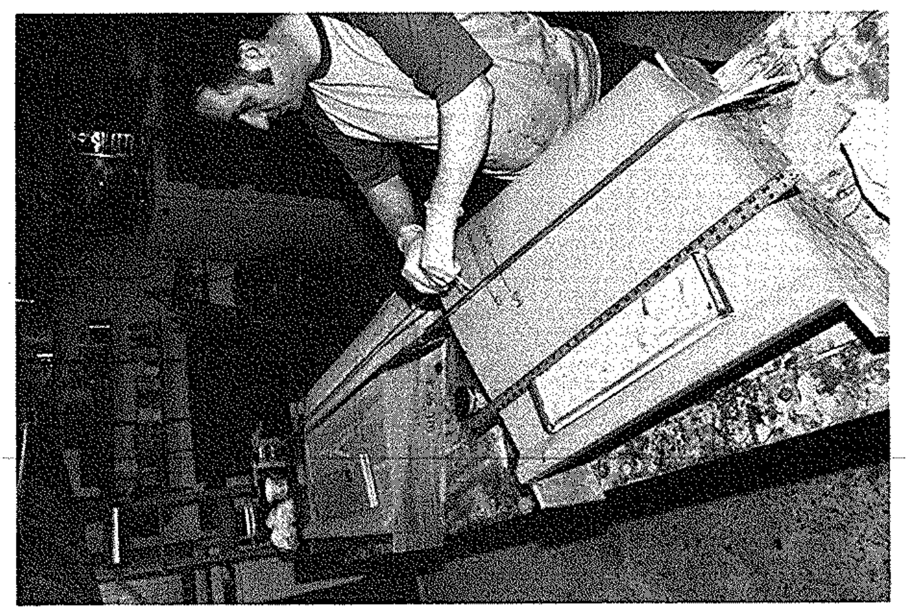
93. Winglets. Shear web layup ④ and ⑤.



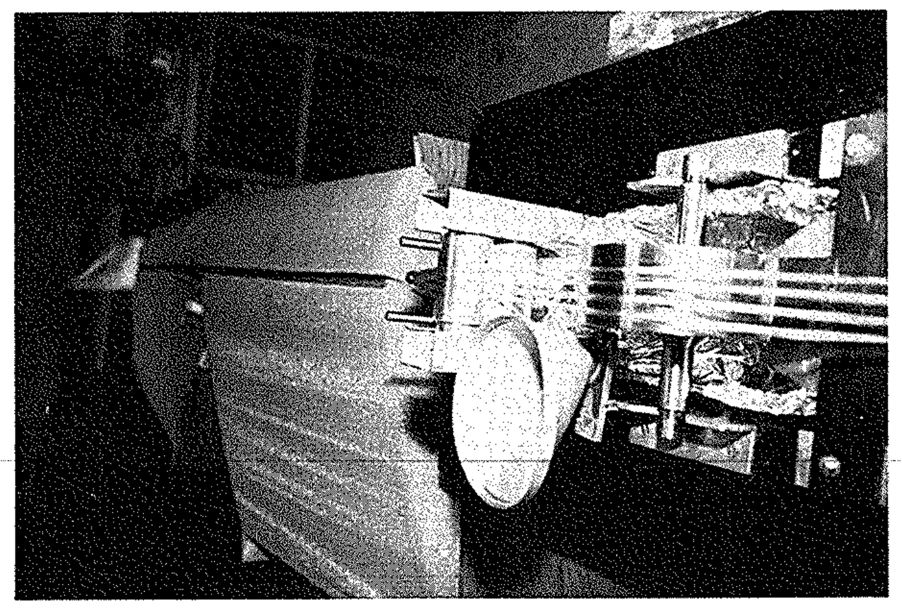
94. Winglets, LEFT AND RIGHT. Using winglet jigs (D-7) set up cores for spar cap layups. NOTE: Forward and aft foam cores are reconnected with wet flox.



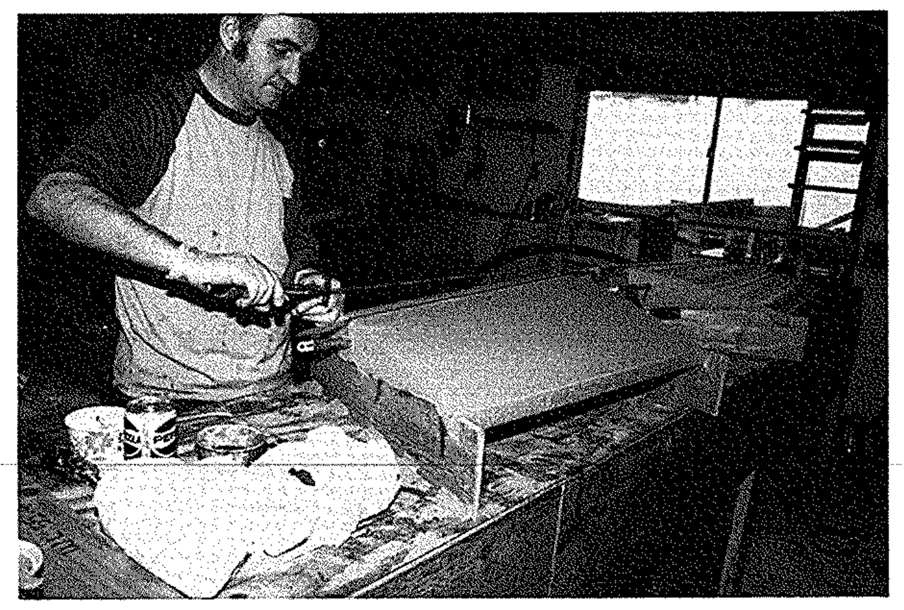
95. Winglets. Doing spar cap layups. Note: Both winglet spar caps are done at same time.



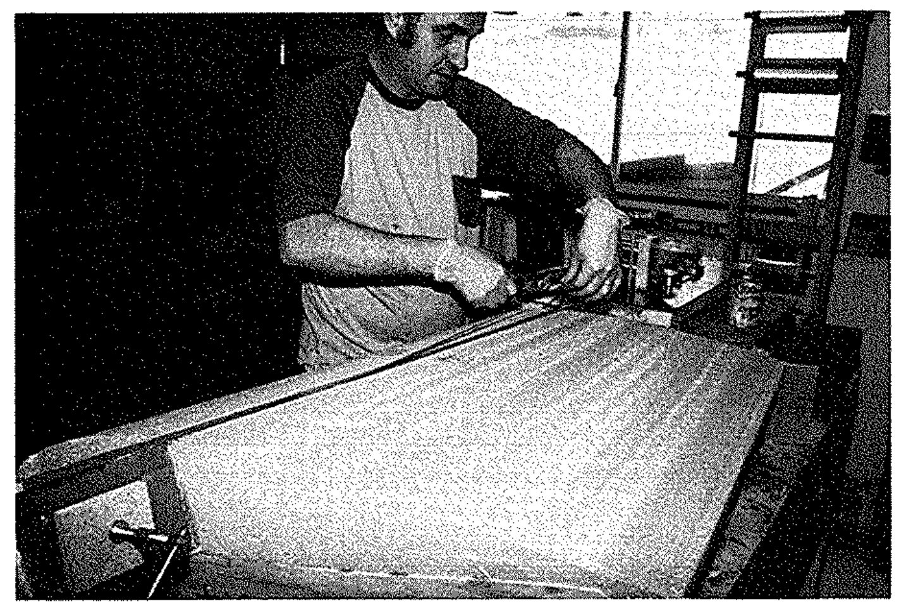
96. Winglets. Spar cap - 'S' glass layups. Longest strands of 'S' glass are first. Shortest strands of 'S' glass are last.



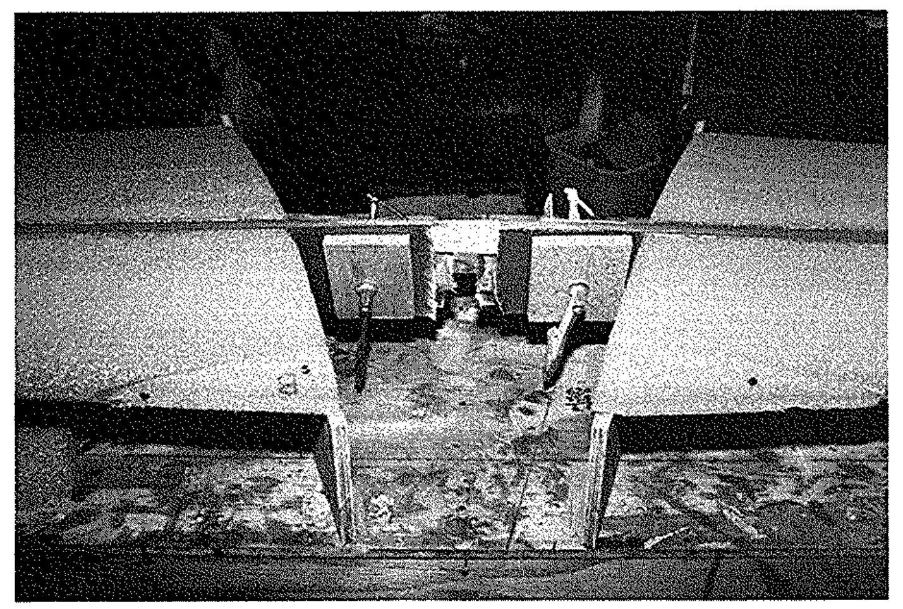
97. Winglets. Showing wet out machine.



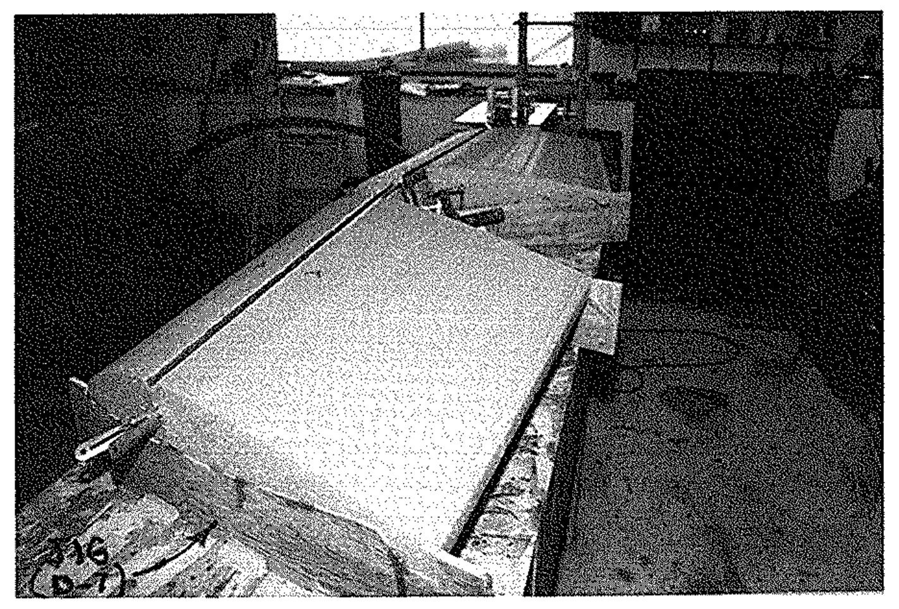
98. Winglet Spar Caps. SQUEEGEE caps after placement of every 8 to 10 strands of 'S' glass.



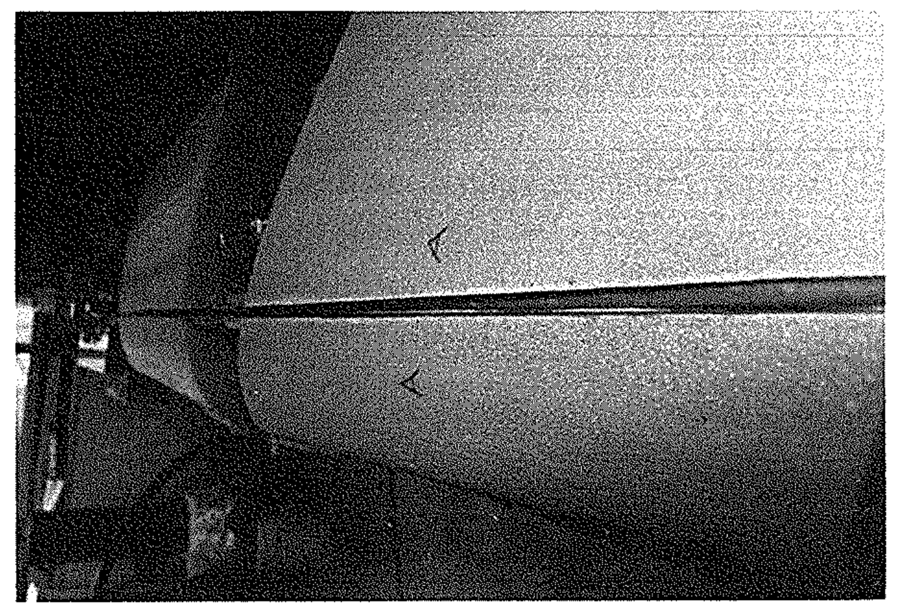
99. Winglets. Cutting 'S' glass.



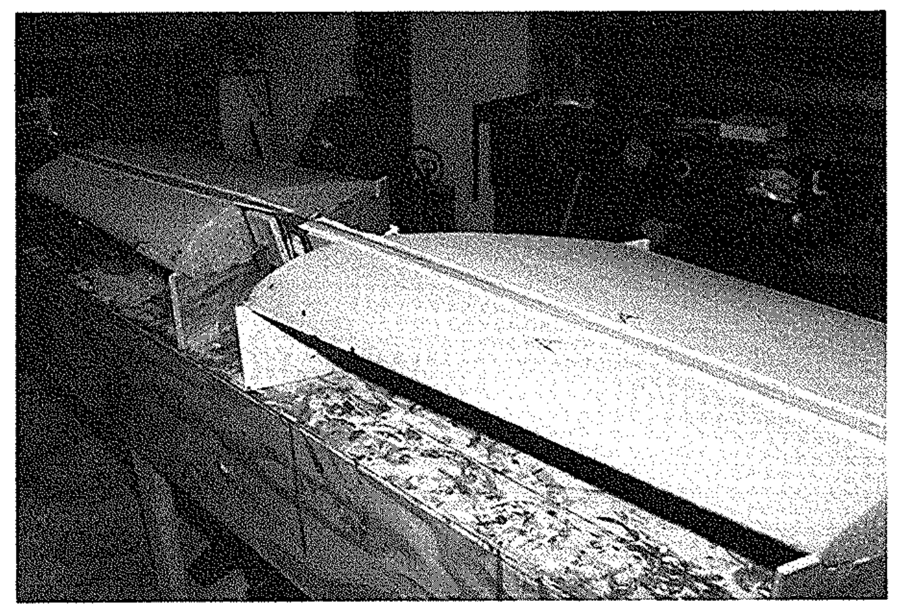
100. Winglets. Shows 'S' glass spar cap going from one stub to the other of each winglet. Cut with heel saw after cure to separate.



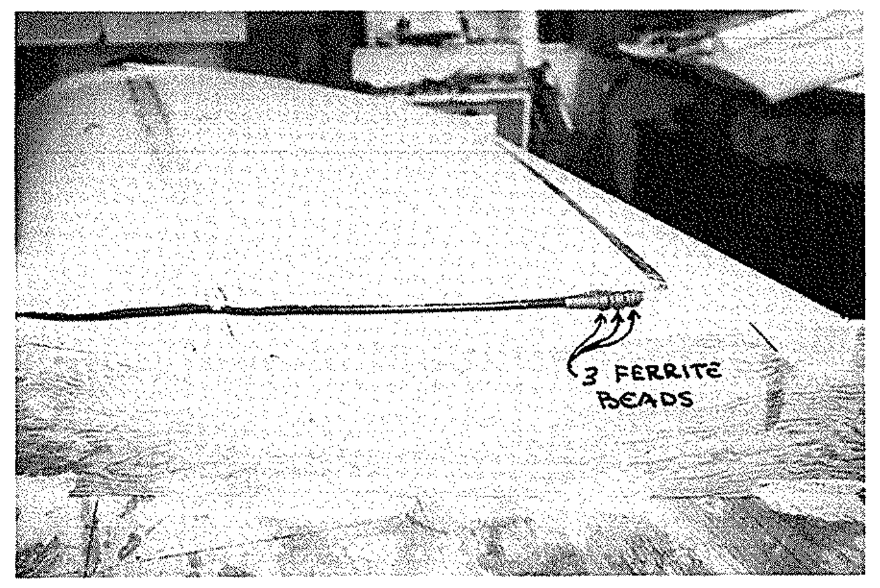
101. Winglets. Lower foam cores with shear webs of winglet.



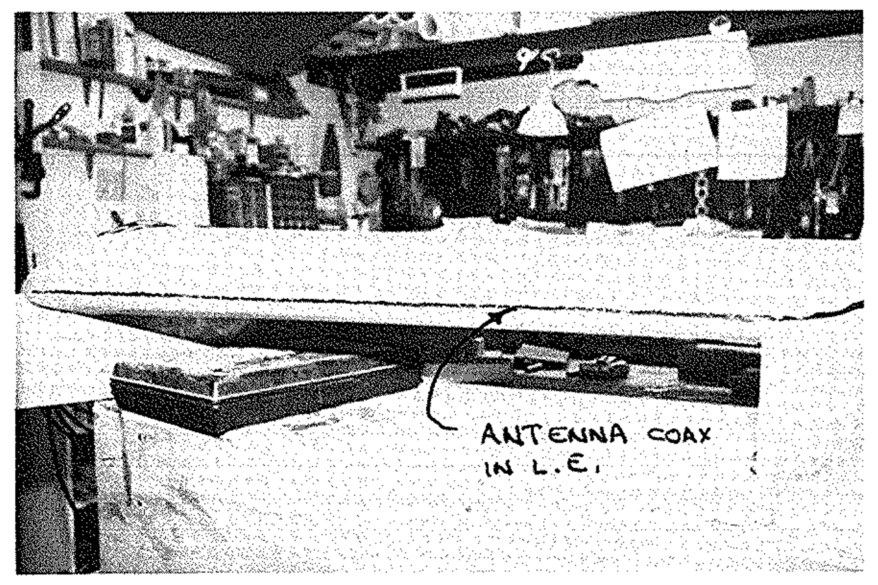
102. Winglets. It helps to identify foam cores with marking pen to keep things straight. This is a look at spar trough before 'S' glass layup.



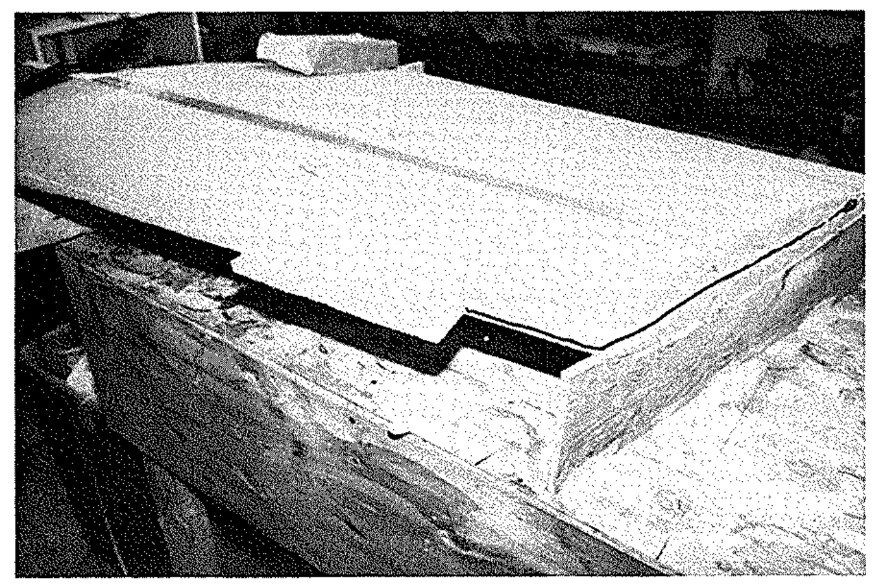
103. Winglet. Shows embedding coax into foam core with three ferrite beads at antenna end.



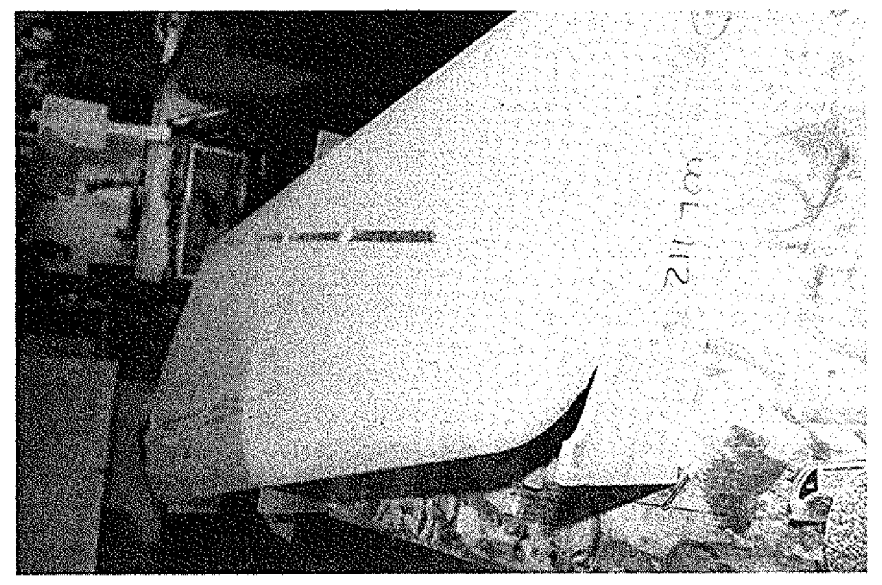
104. Winglet. Cut trough in leading edge to rout RG58AU coax.



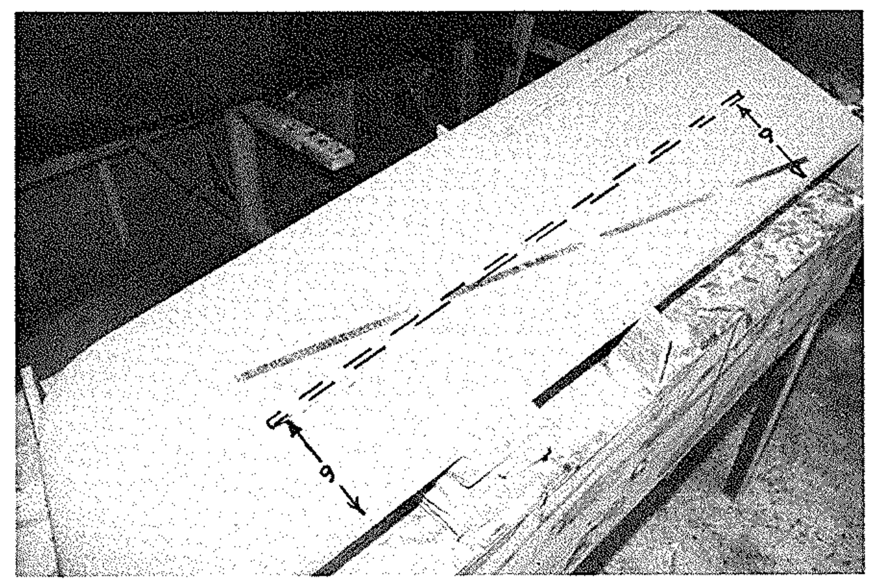
105. Winglet. Cut trough in leading edge to route RG58AU coax.



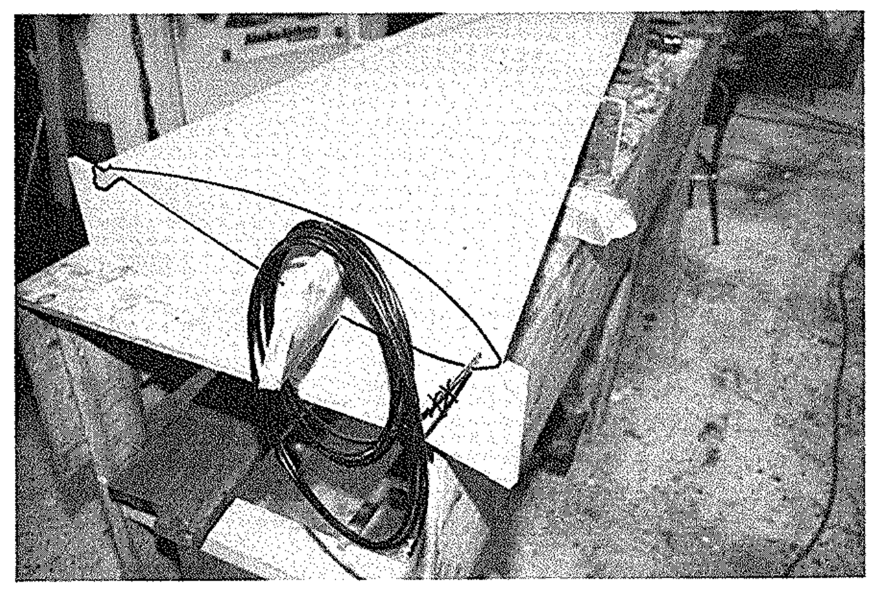
106. Winglet. After placing coax, fill trough with foam wedges and reshape leading edge. Micro foam wedges in place.



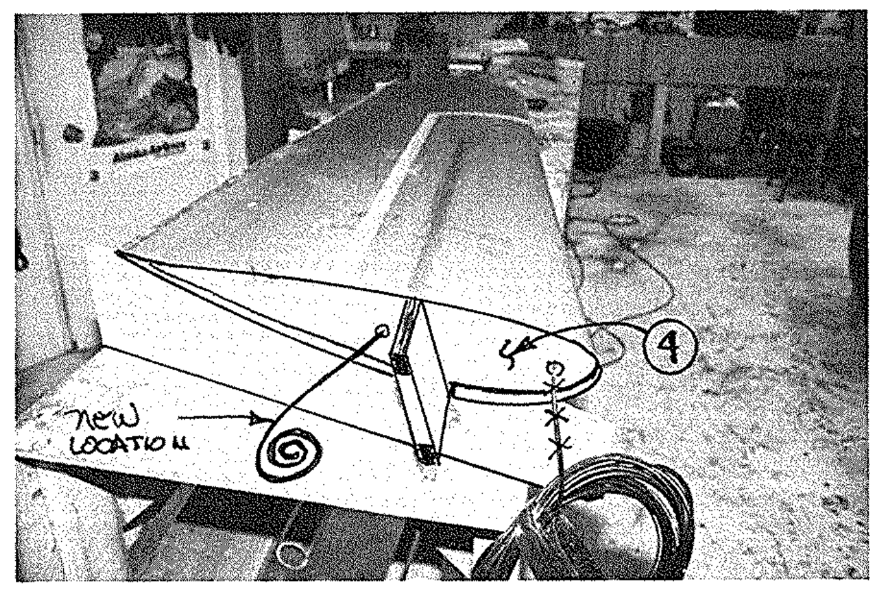
107. Winglet. After adjoining upper and lower cores together with micro, shape upper leading corner as shown.



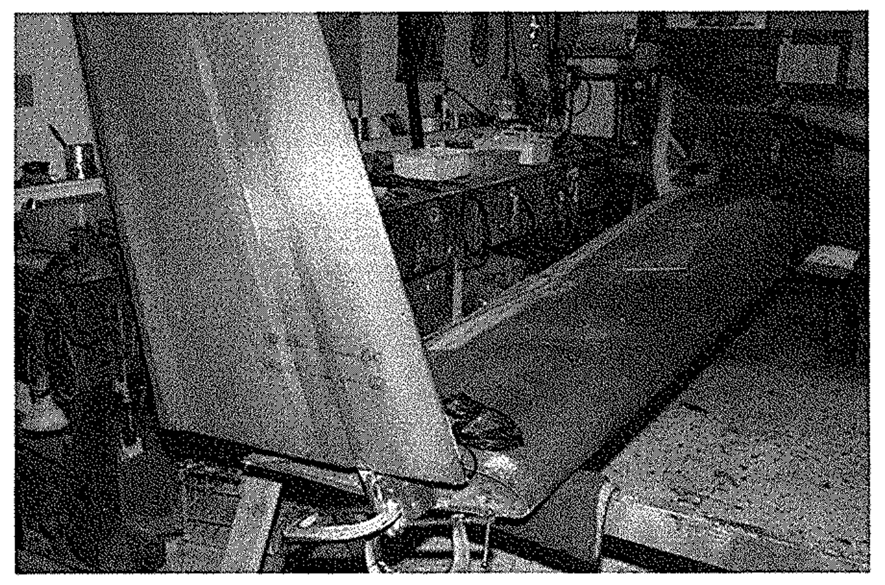
108. Winglet. NOTE: Antenna has been placed in different locations in plans than shown in photo. Dotted line indicates new location. (SEE D-21).



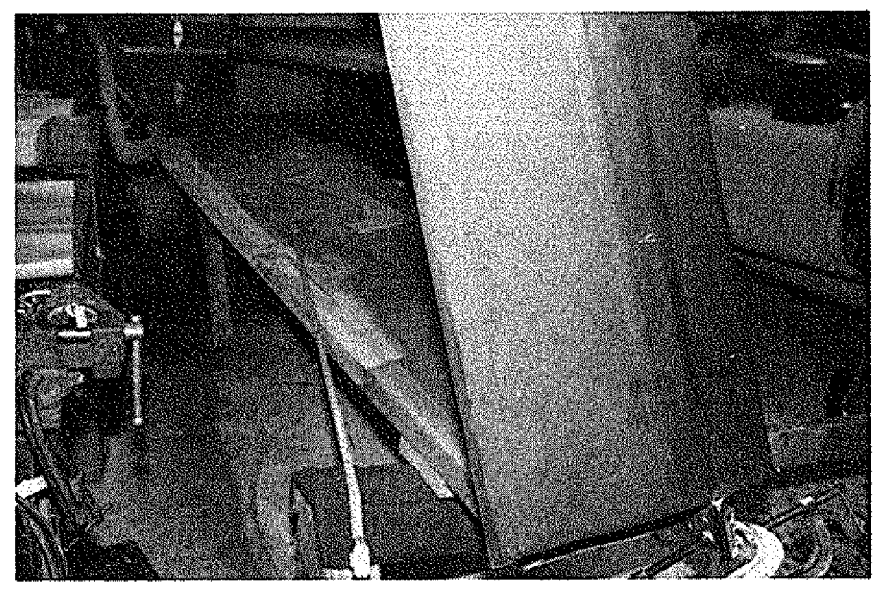
109. Winglet. Also coax as shown here has been relocated to aft. Side of winglet spar due to new and better conduit location in main wings.



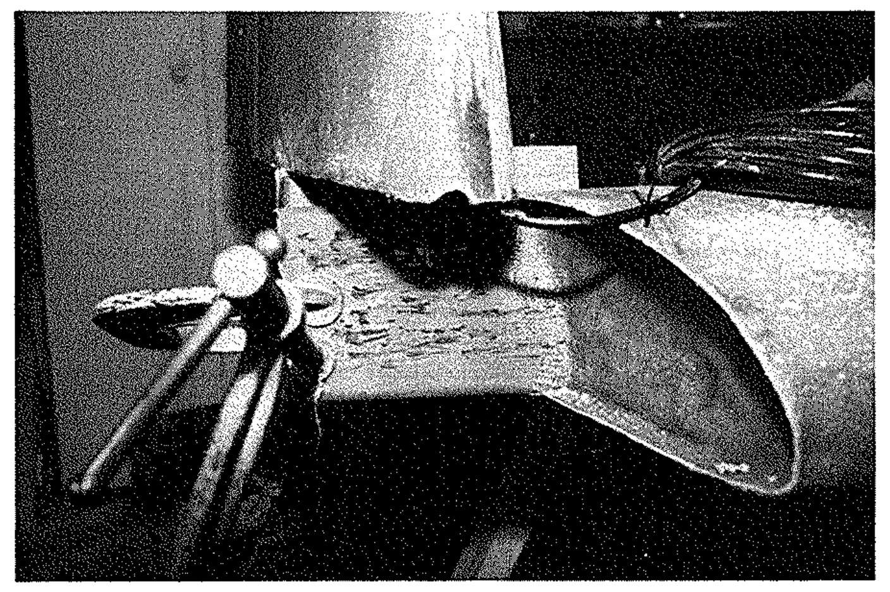
110. RIGHT Winglet. Showing new location of coax cable. D-21 has illustration of drilling new route.



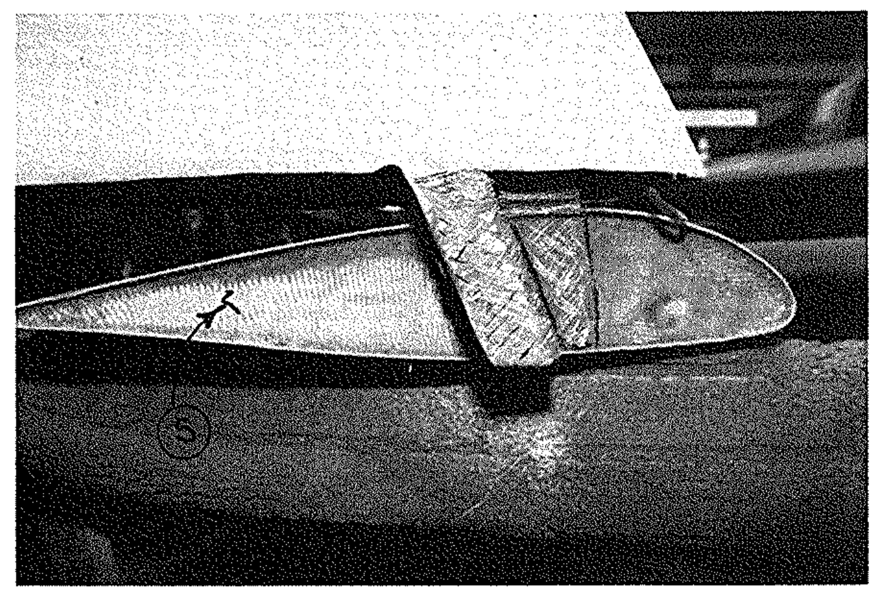
111. Right Winglet. Setting up winglet to right wing. Note the step of construction is done just before final assembly and finishing of aircraft. Also layups 4 and 5 end ribs have been completed



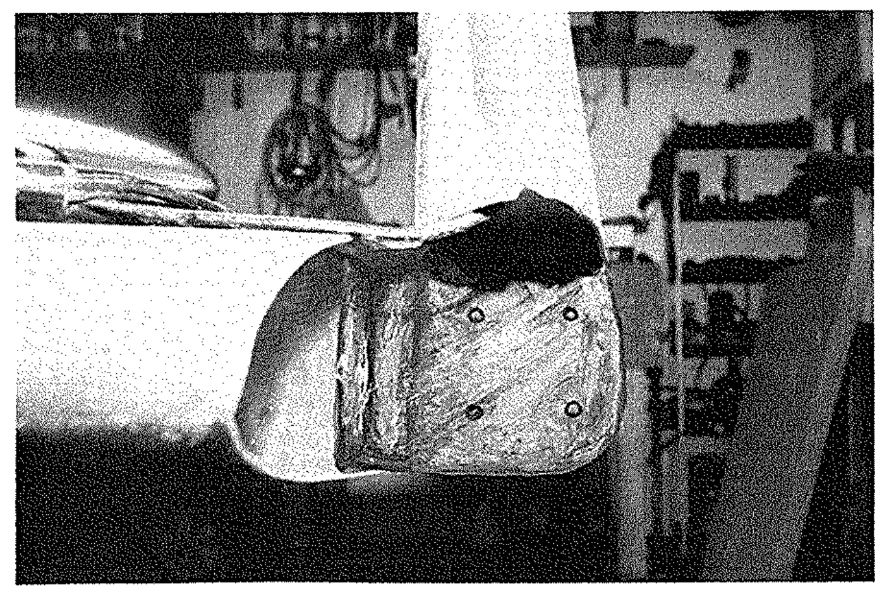
112. Right Winglet. Carefully measure and position winglets to the A, B and C dimensions shown on D-21. Use scrap pieces of precured 2 plies BID as shims to adjust mating wing and winglet stubs.



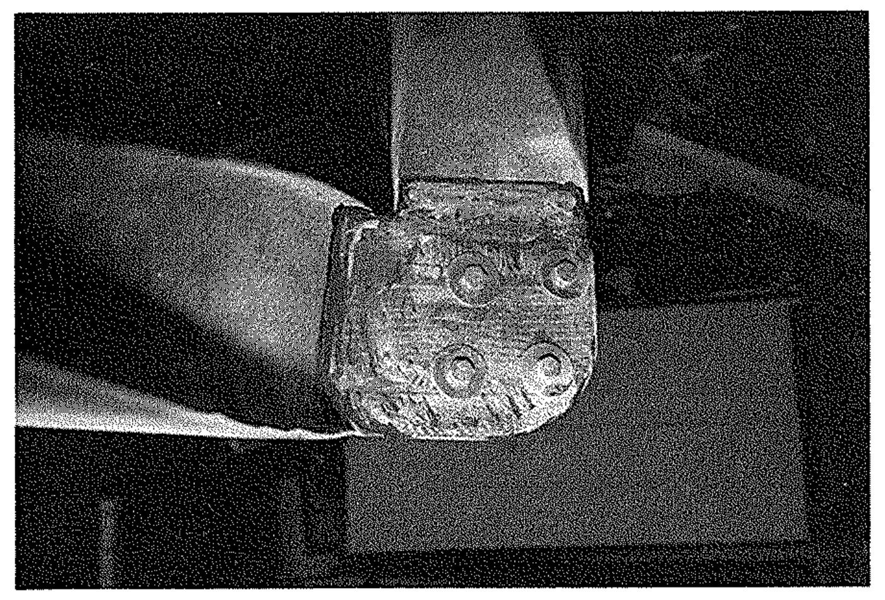
113. Right Winglet. Once A,B and C dimensions and shim requirements have been established, apply flox to mating surfaces and clamp until cured. After cured continue with required layups.



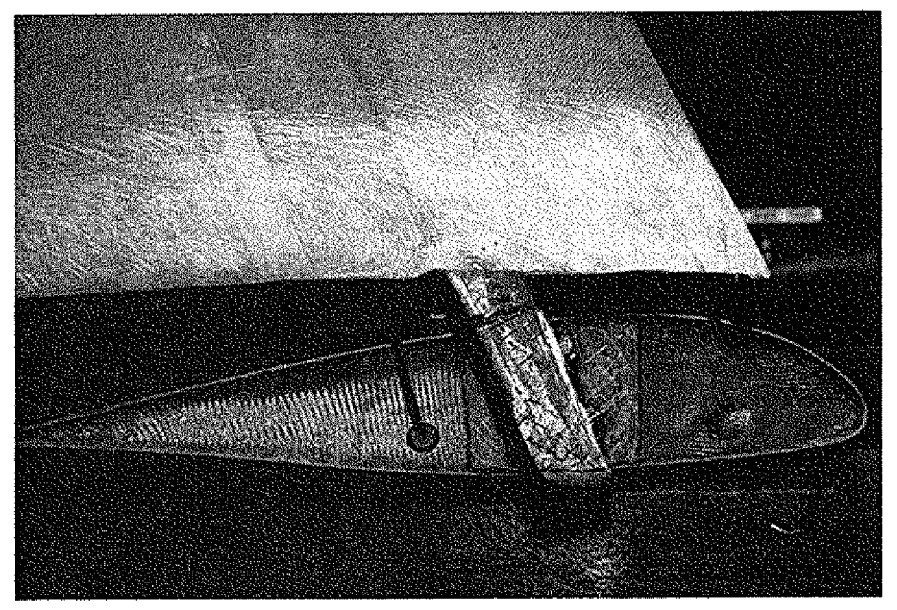
114. Right Winglet. Showing layup 6 . (SEE D-21)



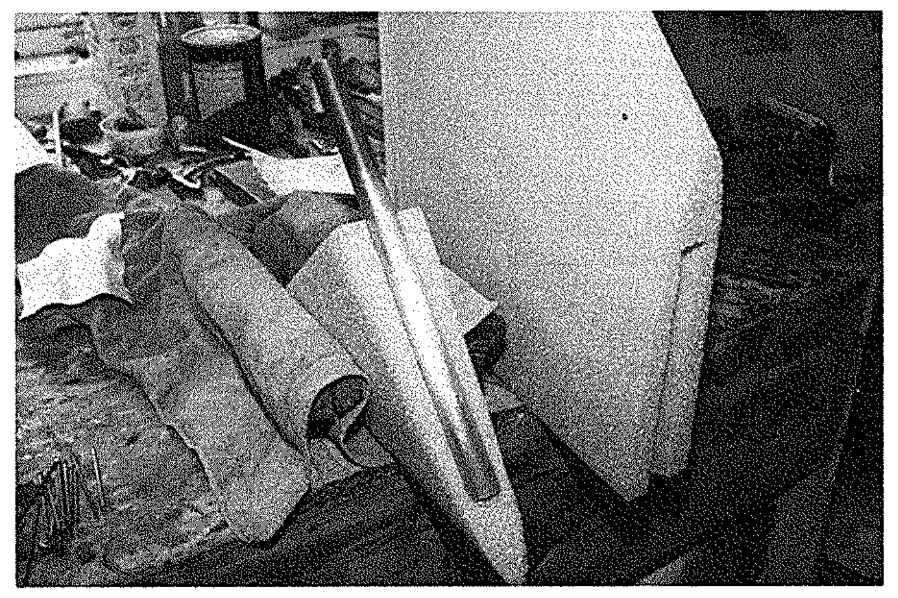
115. LEFT Winglet. Showing 1/4" holes which are drilled after completion of layup ⑥ and ⑦. Use care not to hit any spar caps - wing or winglet.



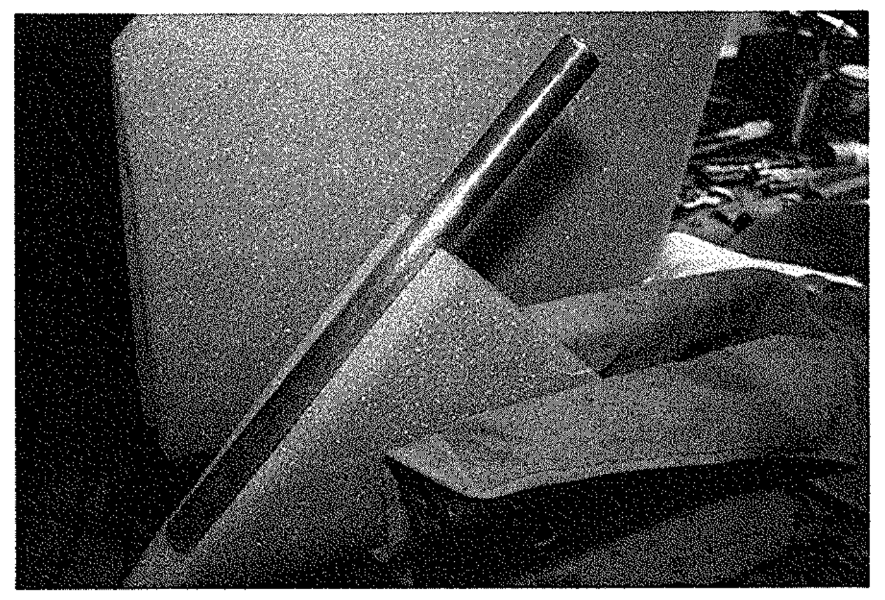
116. Winglet. Final bolting of stubs together after all layups are completed. Anchor ANC-1 is not shown.



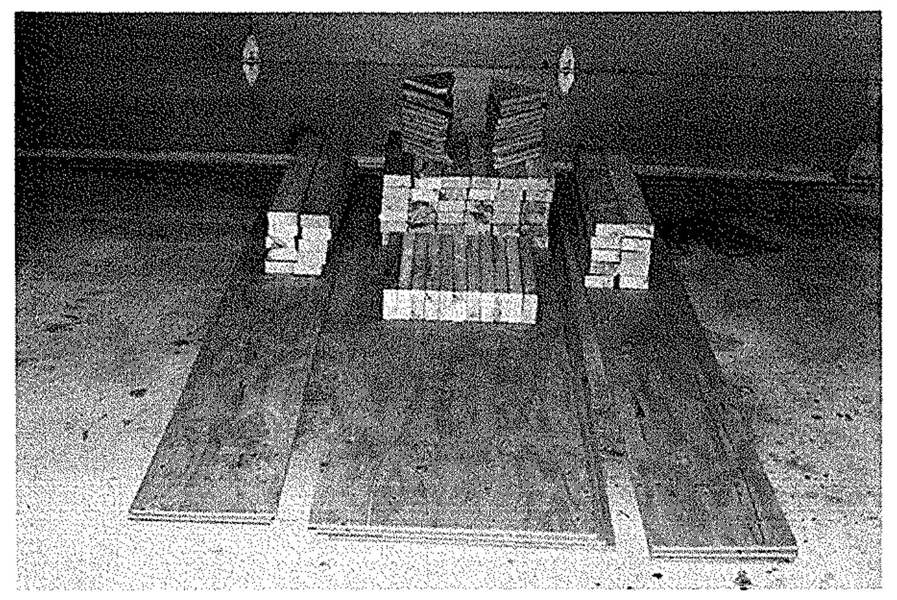
117. RIGHT Winglet. Completed winglet attachment before installing foam blocks and glassing winglet to wing.



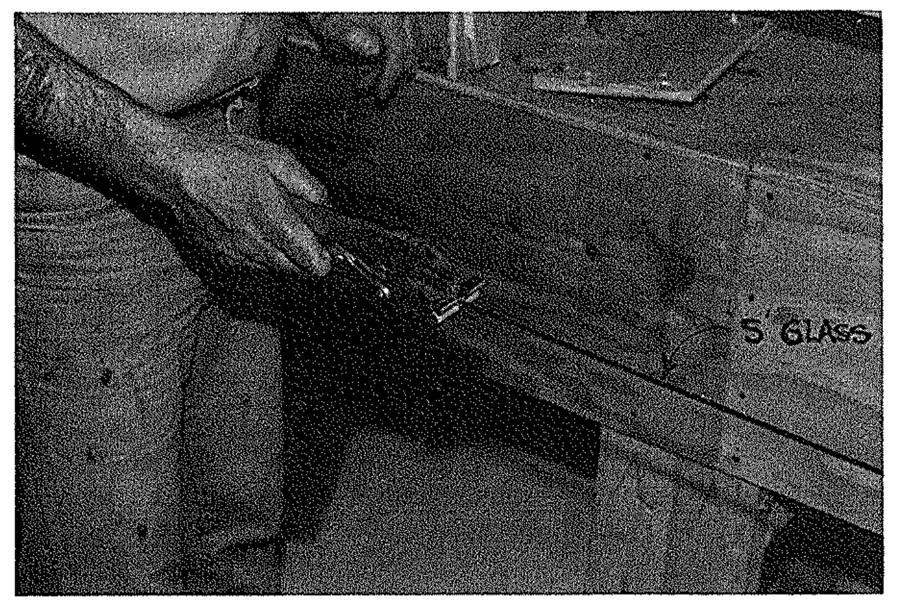
118. RUDDER. Foam core cut into and trough made for 1 x .065 4130 steel tube. (SEE D-57).



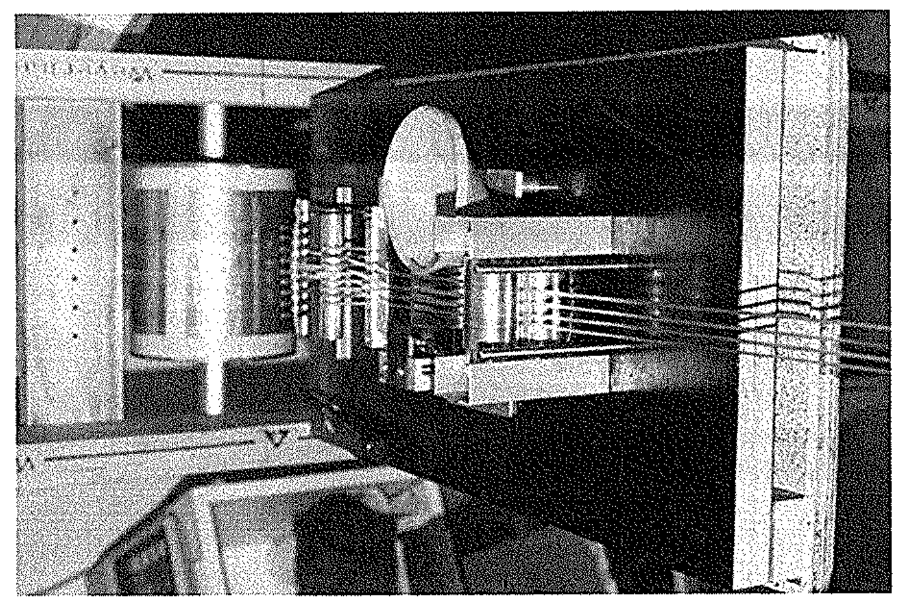
119. Rudder. After "spar" layup has been complete, micro cores back together with steel tube in place. Rough surface of tube (36 grit) to provide good bond.



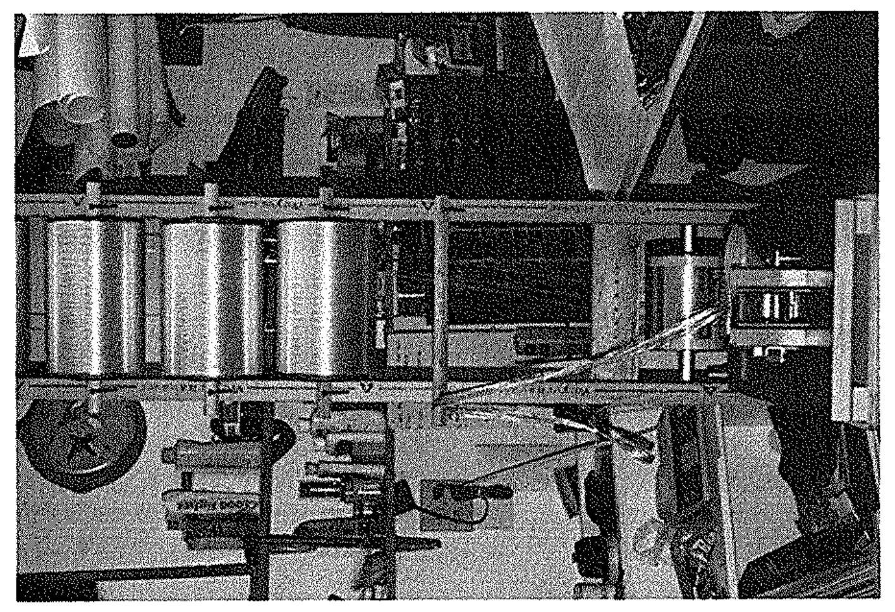
120. Work Table. Materials required to build 2 EACH 8 foot tables and 2 EACH 4 foot tables. All interlocking to form several lengths up to 24 feet.



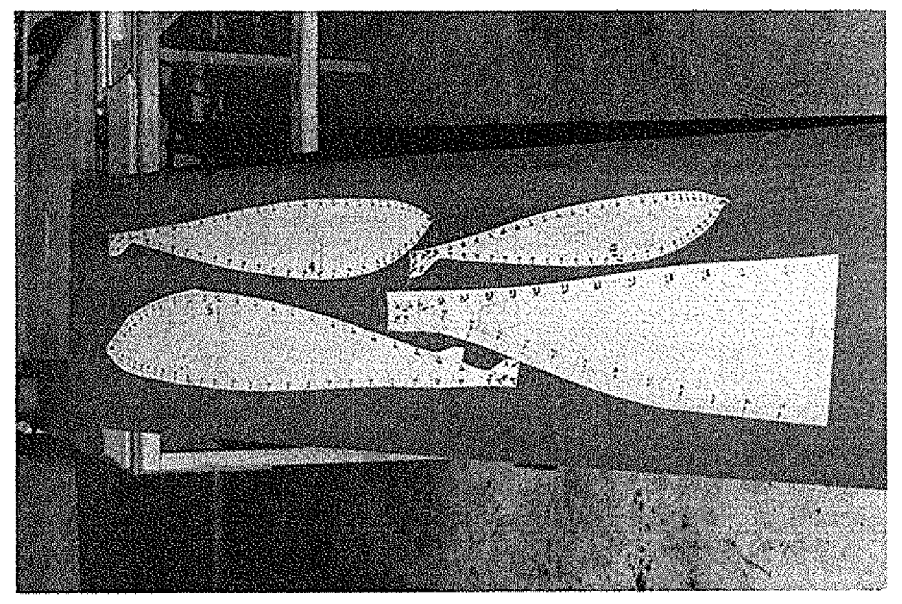
121. Vise grip plies with 3/8" x 2" steel rod or bolt shank welded to provide easy clamp for pulling 'S' glass.



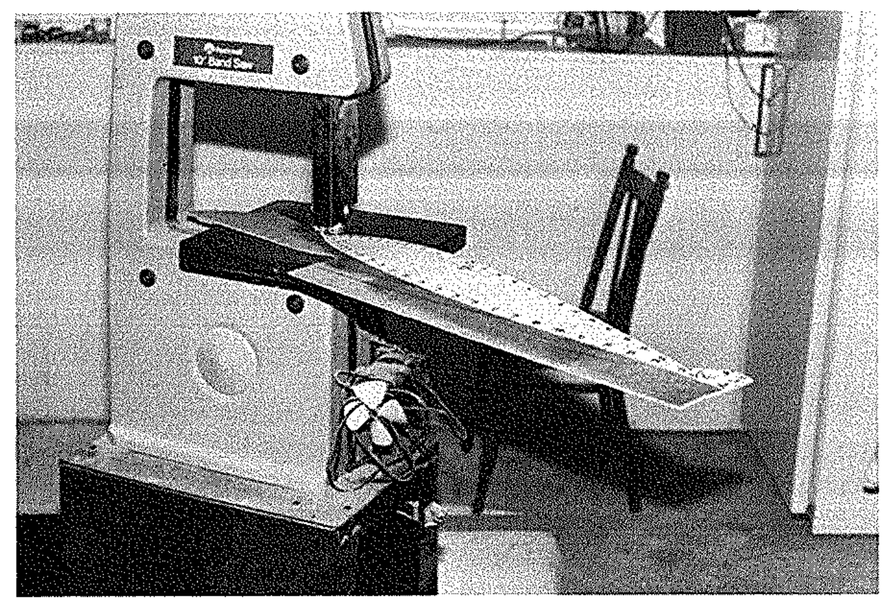
122. Strands 4 to 6 EACH from spools going through wetting machine and forming the one strand as referenced in plans.



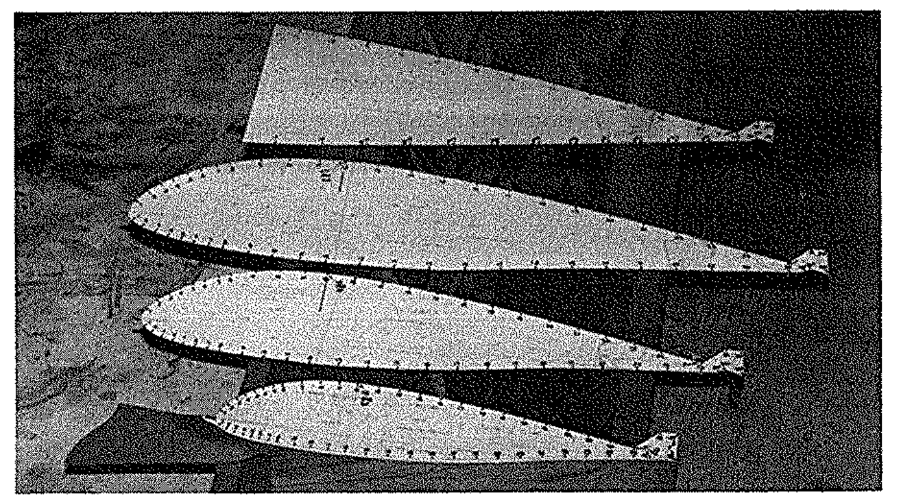
123. Rack to hold 4 spools of 'S' glass. Rack is 8 feet long and is wedged between floor and ceiling of work shop to provide a mobil but very stable unit.



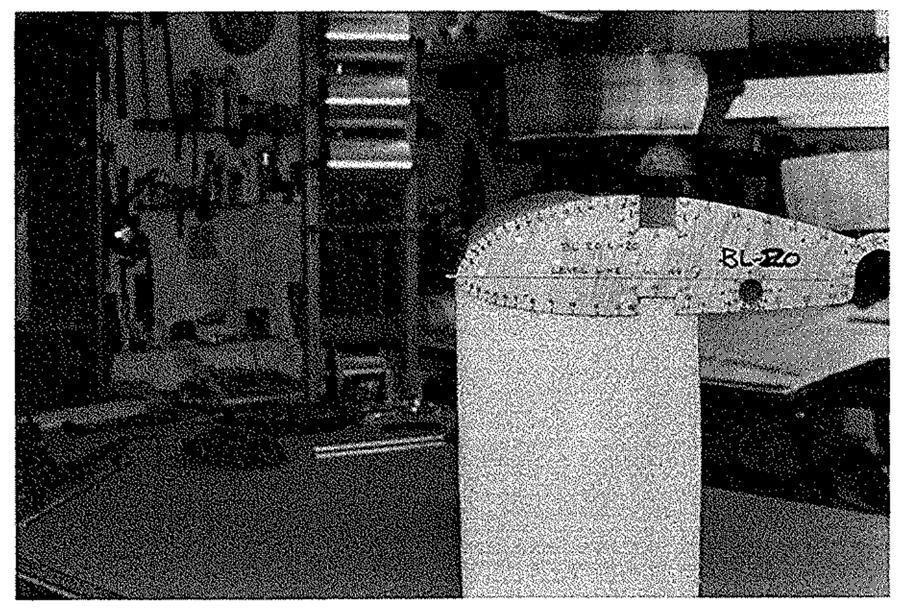
124. One form of template material is hollow core door (birch or mahogany). Attach paper template (over size) to door with spray contact cement and cut with jig saw blade or remove door skin and cut on band saw.



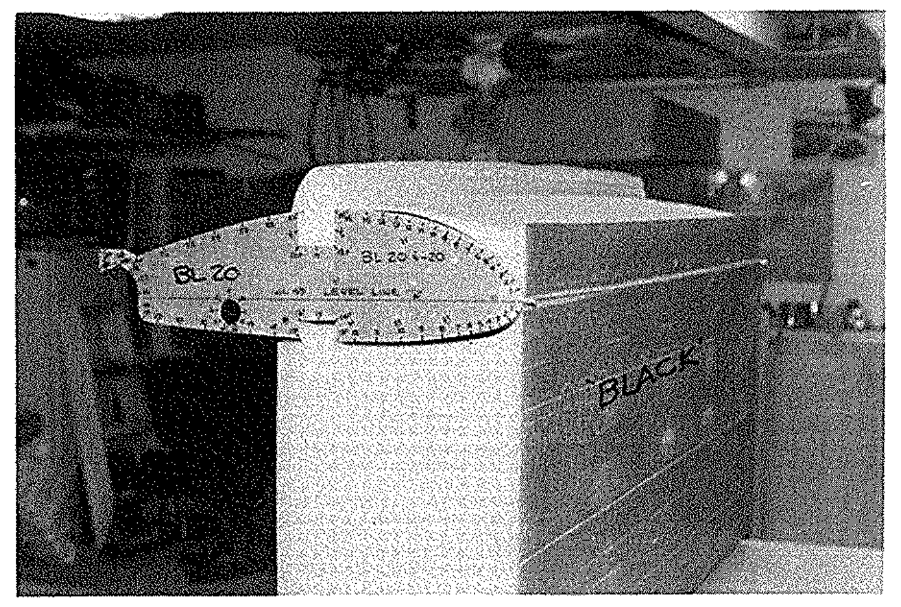
125. Using band saw to cut templates.



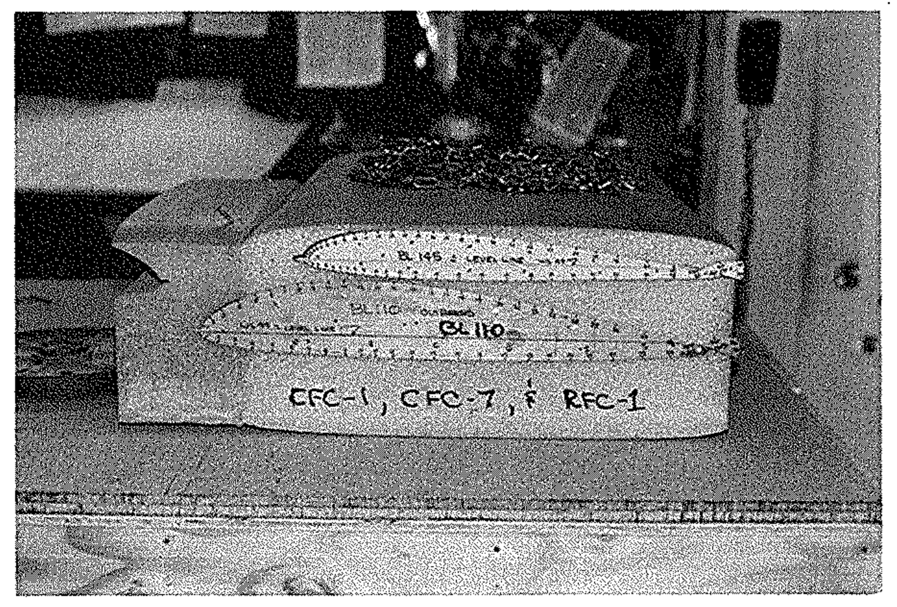
126. Cut or break a 32 tooth jig saw blade to maximum thickness of hollow core door. Now you can cut templates without overhanging edge of table, simply cut through raised skin of door.



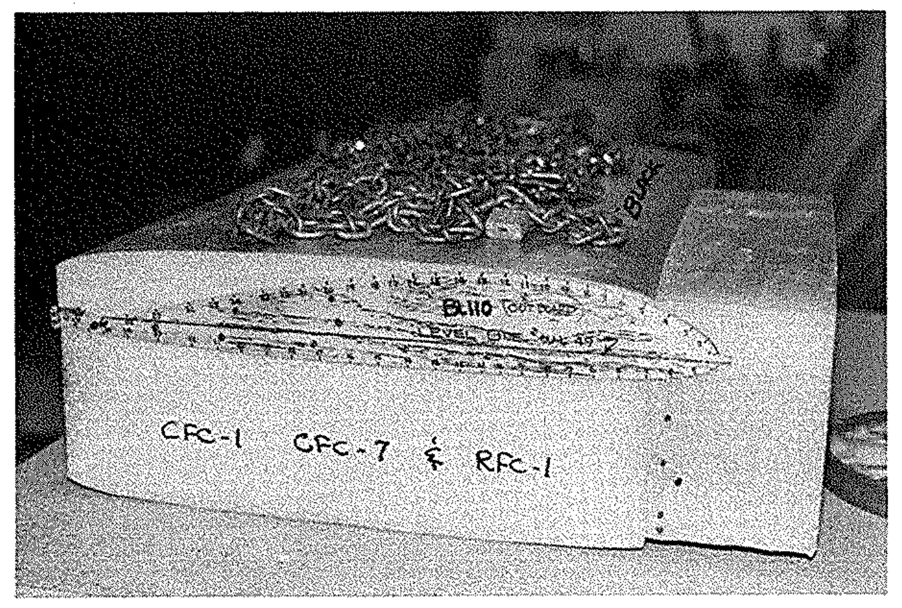
127. Canard. Hot wiring CFC-4 (B.L.+20 to B.L.-20). Black block. (SEE D-20).



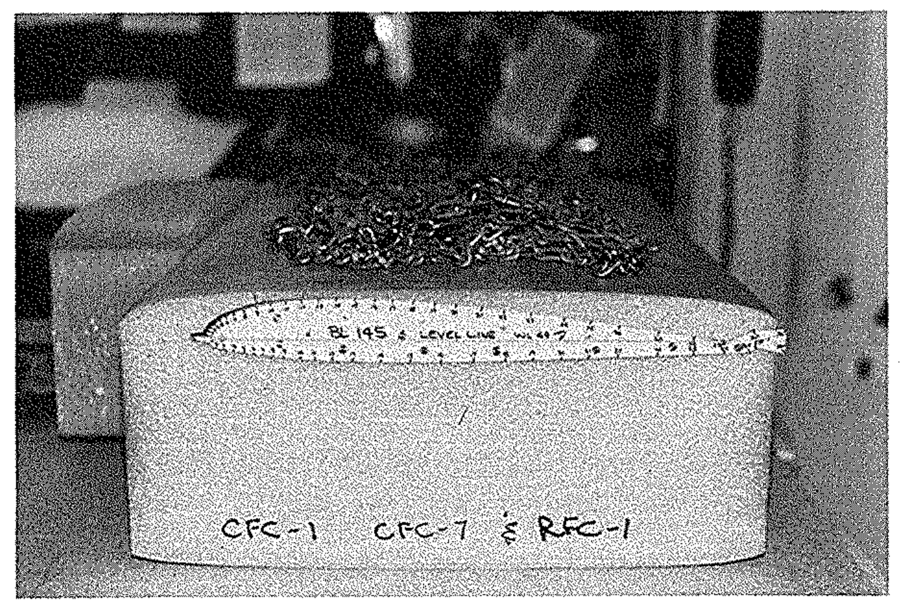
128. Canard. Opposite end of Photo #127.



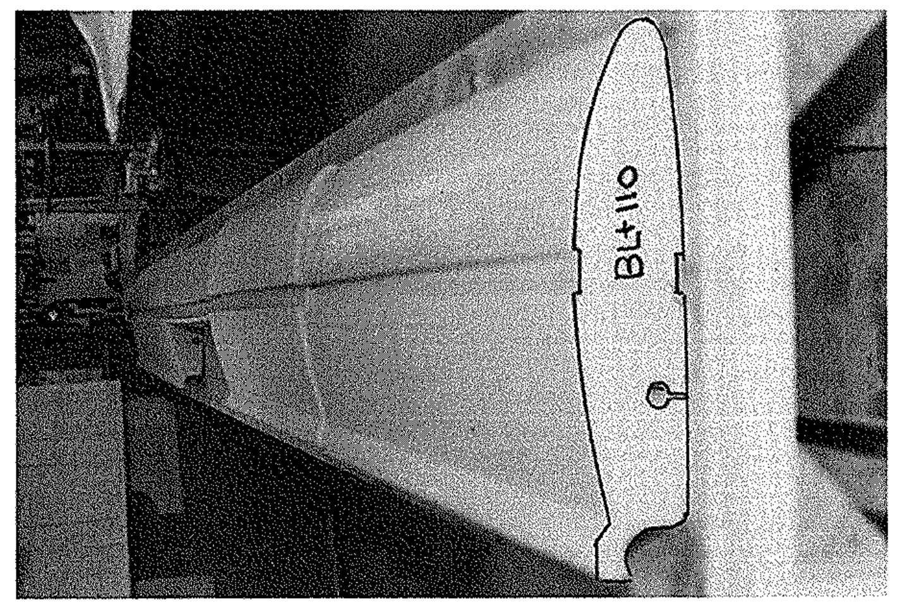
129. Canard. Hot wire templates for canard tips. Shows method to cut one tip in one direction and reversing templates for opposite tip.



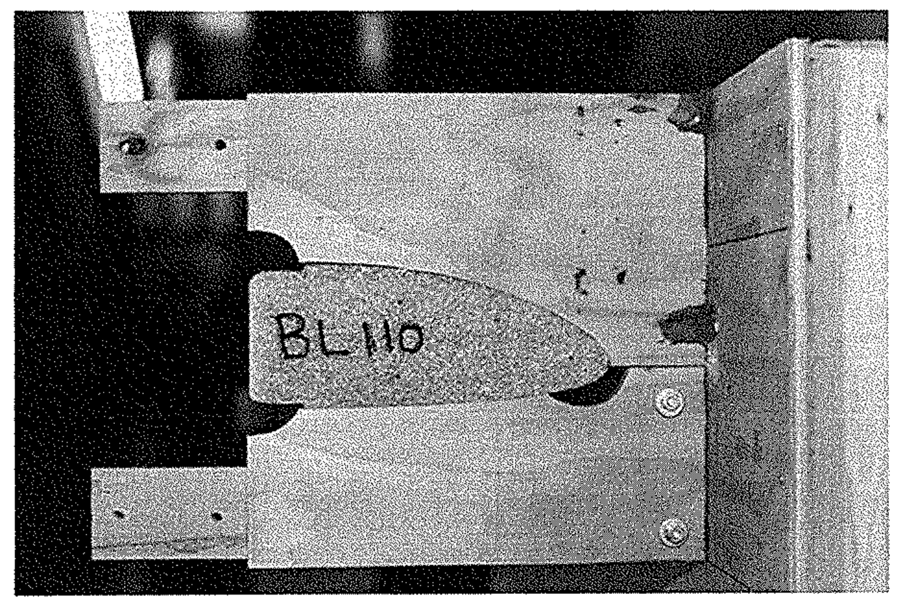
130. Continue canard tip core. (Template B.L.110)



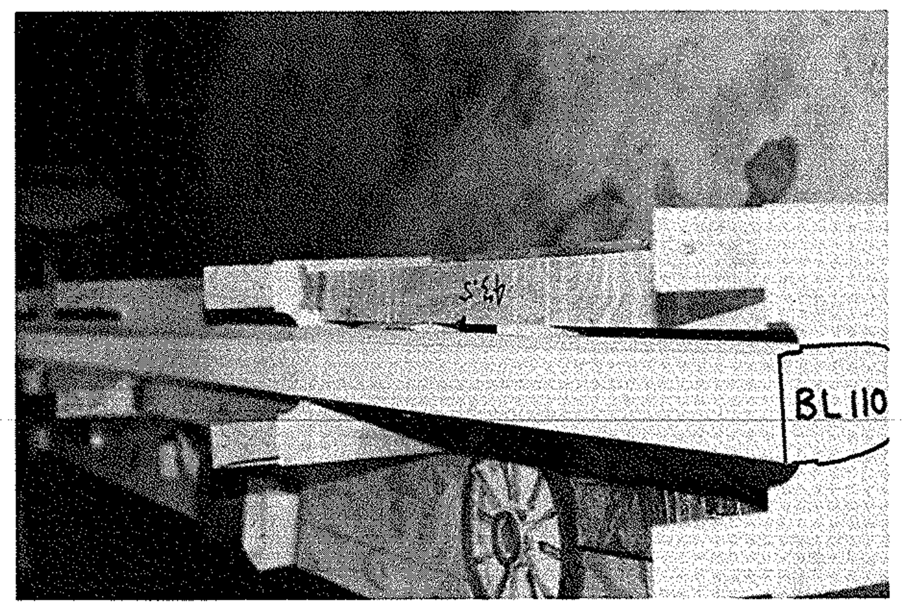
131. Continue canard tip core. (Template B.L.145)



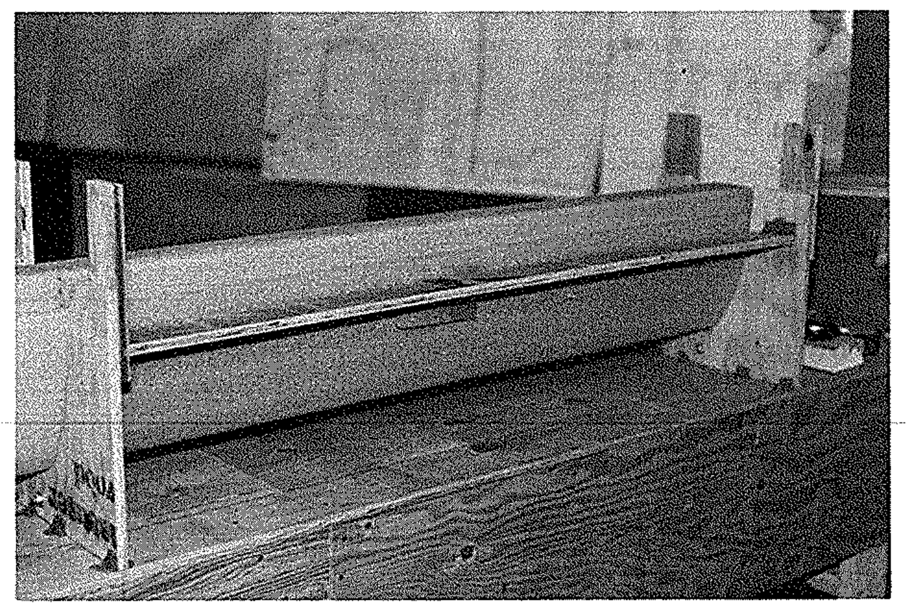
132. Canard foam cores CFC-2 through CFC-6.



133. Setting up forward core in jig after cores have been split at shear web cut. NOTE: Shear web cut is shown on hot wire template. (SEE D-2)

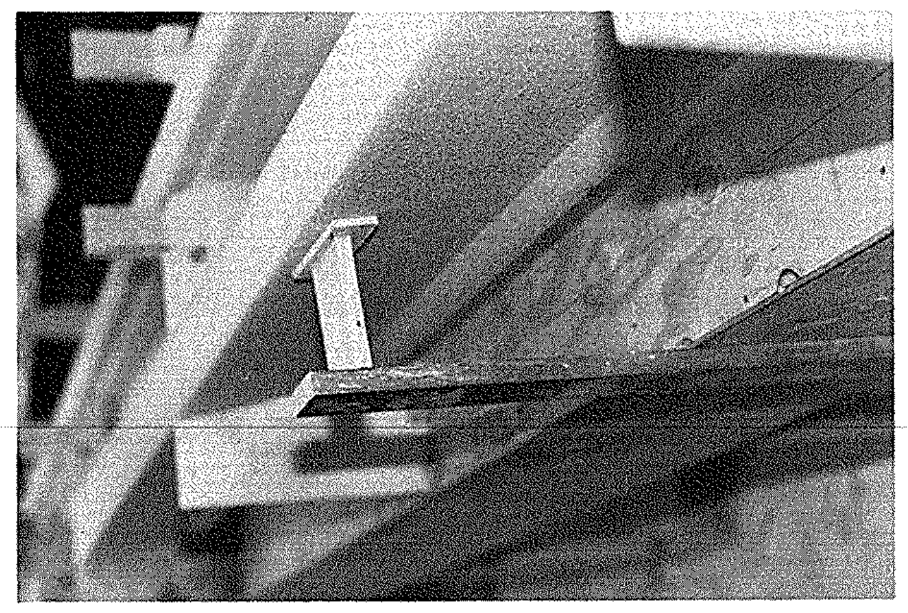


134. Forward of shear web foam core in jig fixtures. (SEE D-2). NOTE cross piece between jigs and wedges to straighten foam core.

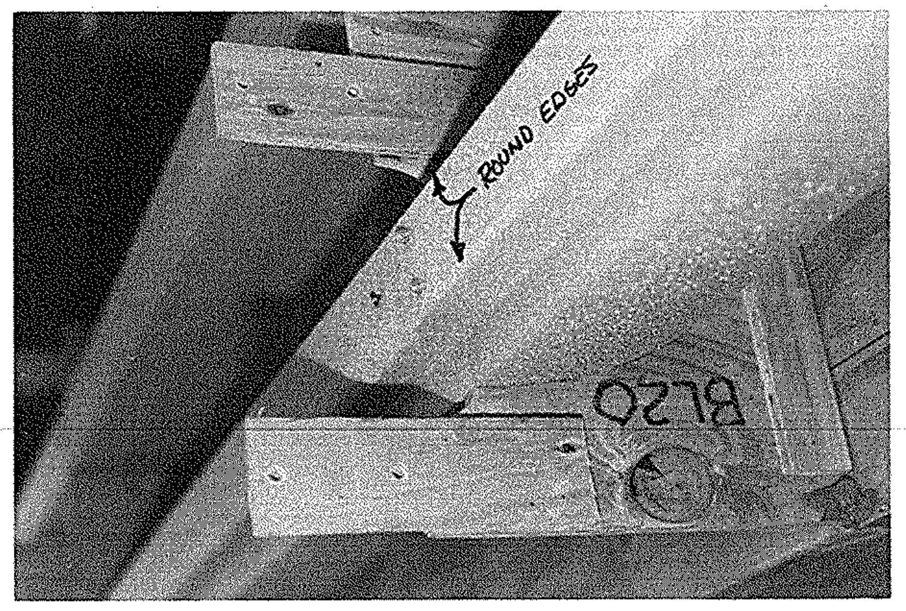


135. Another view of Photo #134. Make sure all foam cores are held straight before glassing any surfaces.

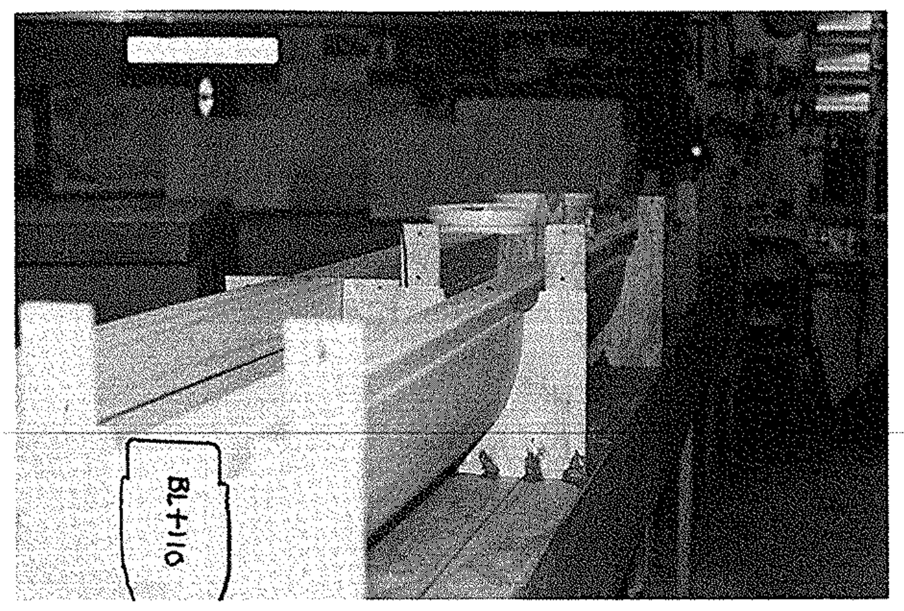
136. Hold foam core straight - as foam is hot wired, the stresses within the foam block sometime bend or twist a core.



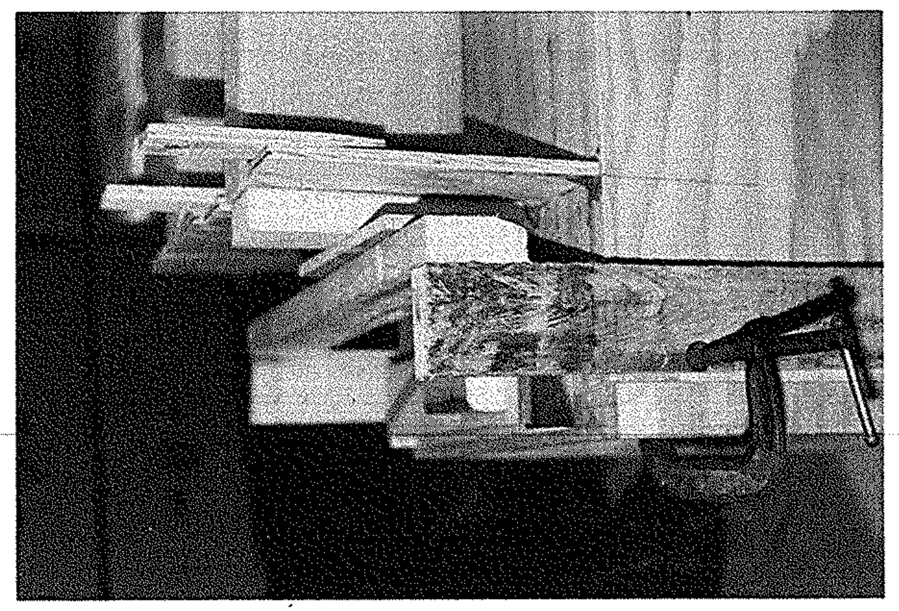
137. Straightening the core aft of shear web. Use micro to glue foam blocks together. Remove any excess micro which squeegees out.



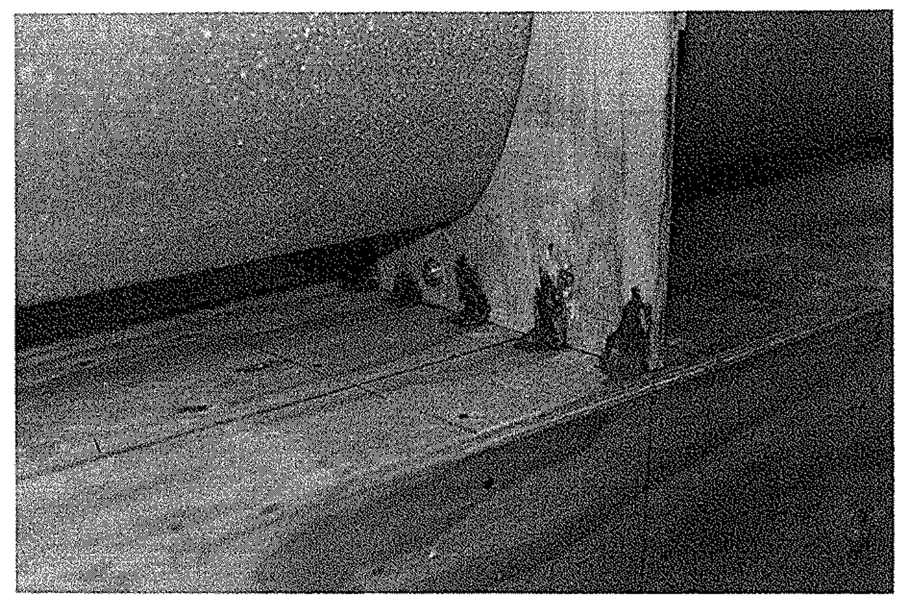
138. Round foam edges for smooth lay of shear web layup.



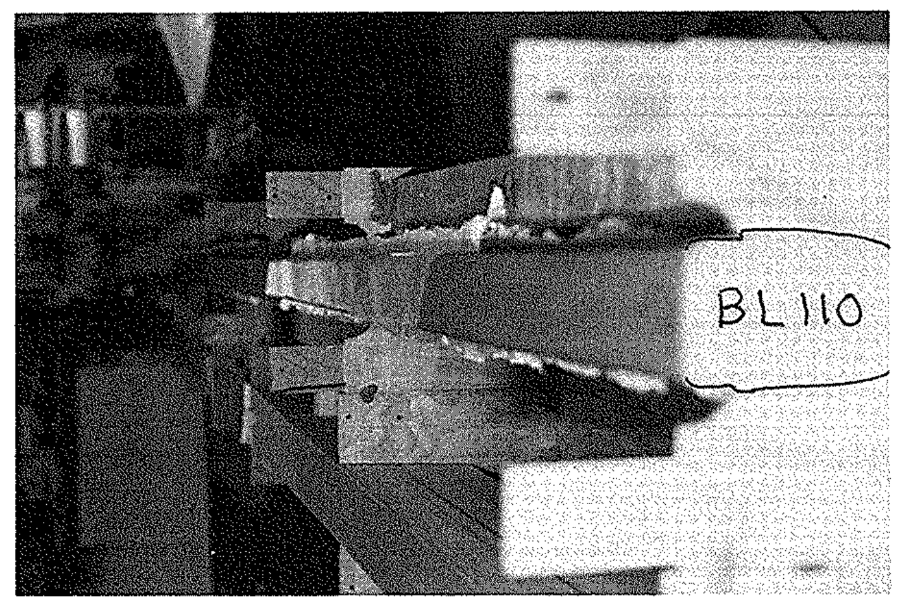
139. Showing FORWARD and AFT cores of canard ready for shear web layups.



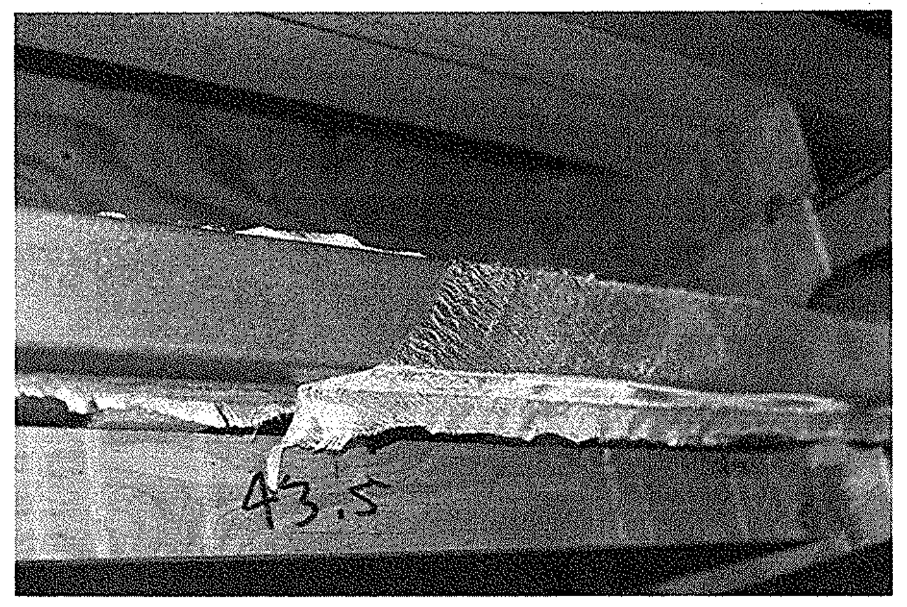
140. Establish a method to apply end pressure. (B.L.-110 and B.L.+110) about 5 lbs. to hold foam cores together while micro is curing.



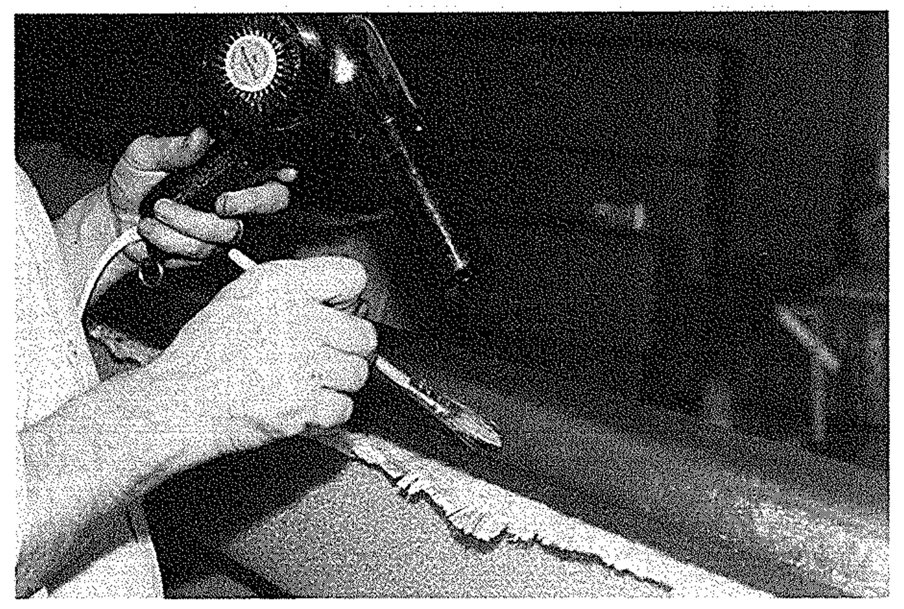
141. Use bondo to hold canard jigs to table.



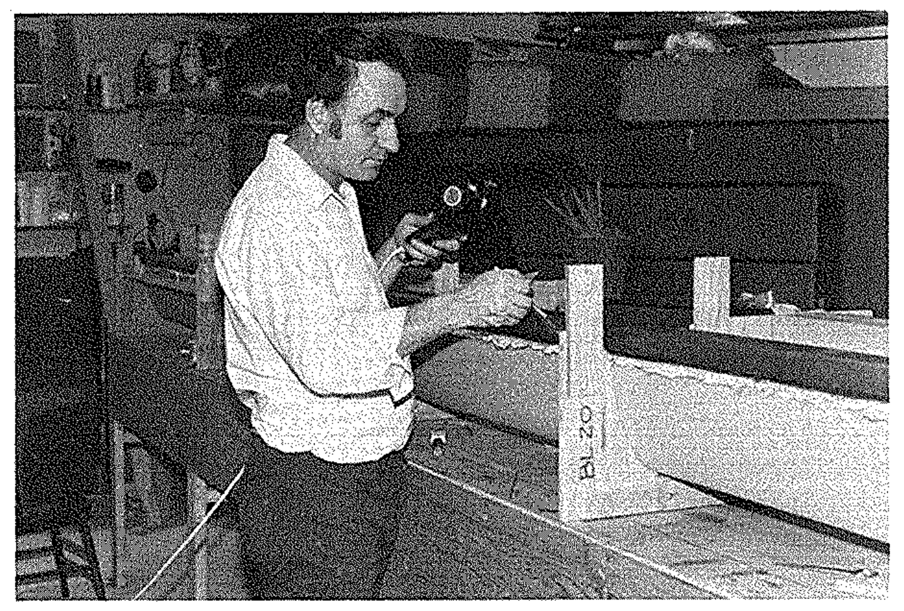
142. Applying shear web layups to forward core. Layup ①.



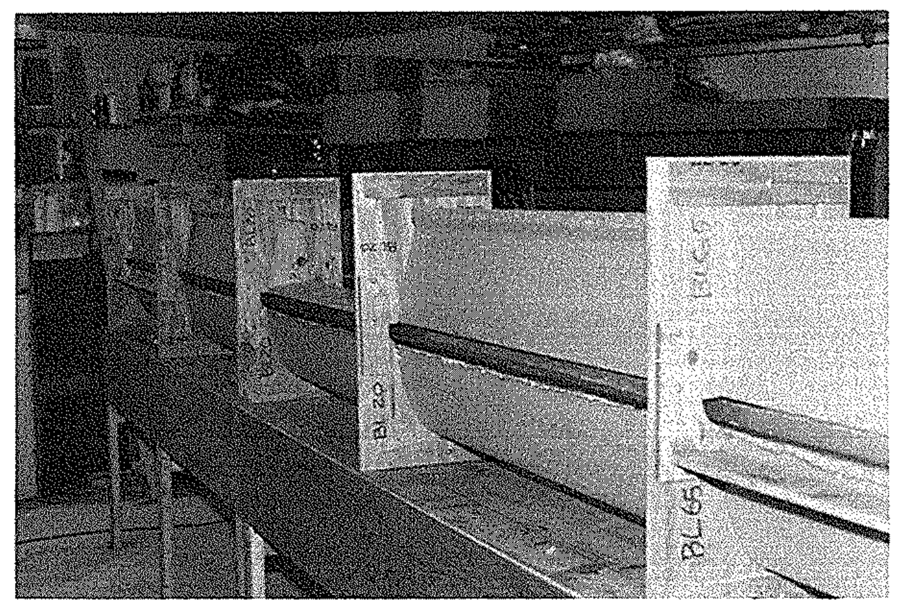
143. Forward shear web. Layup ①. What UND will look like before wetting out with epoxy. Note 45° lay of UND.



144. Use heat gun or hair dryer to aid in wet out of glass. This is typical throughout aircraft construction.

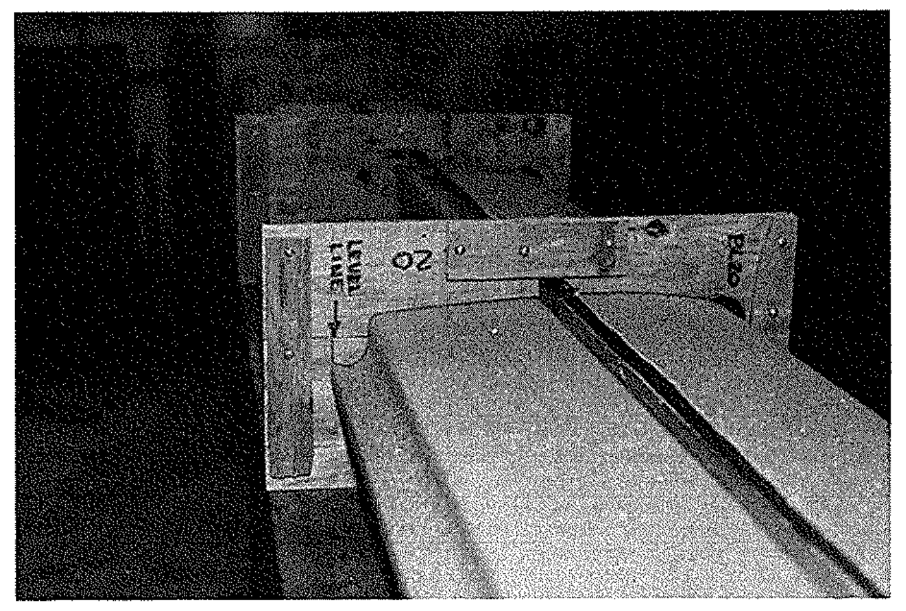


145. Going over shear web layup to insure wetting. Use 2" brush to stipple epoxy. PEEL PLY ENTIRE shear web surface.

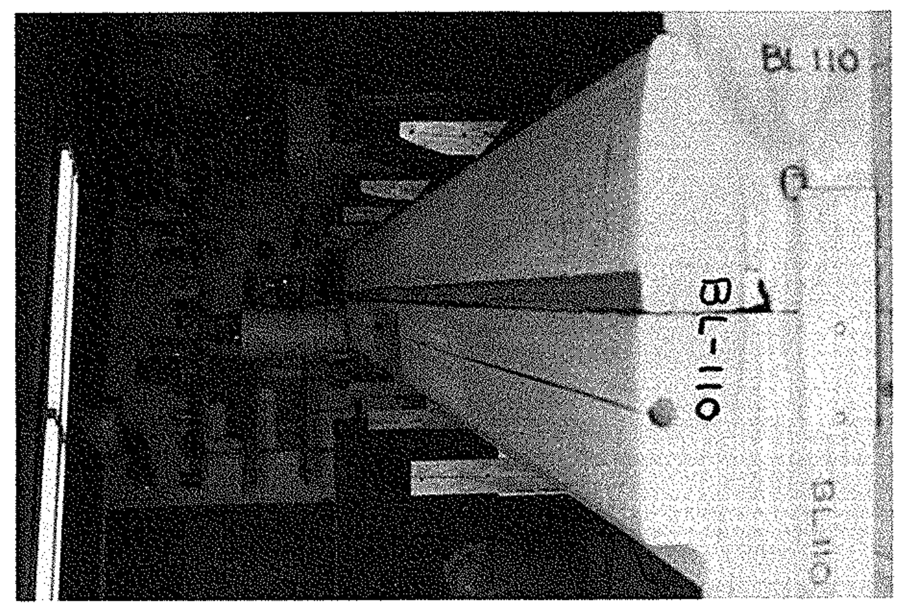


146. Remove peel ply from both FORWARD and AFT shear webs and 1/2" high ridge of micro and reassemble cores as shown. Cut and protect spar cap surfaces from MICRO.

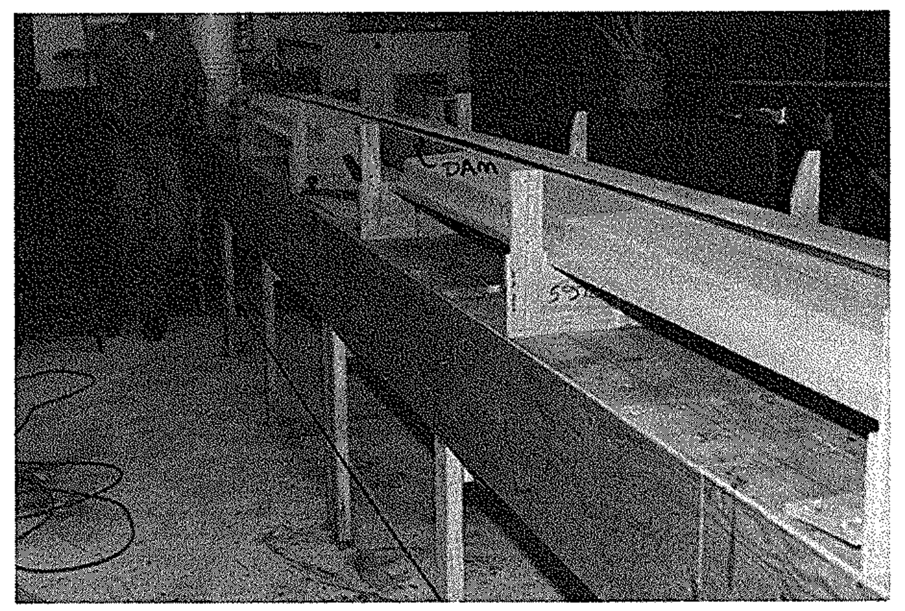
147. Foam cores in jig while micro cures.



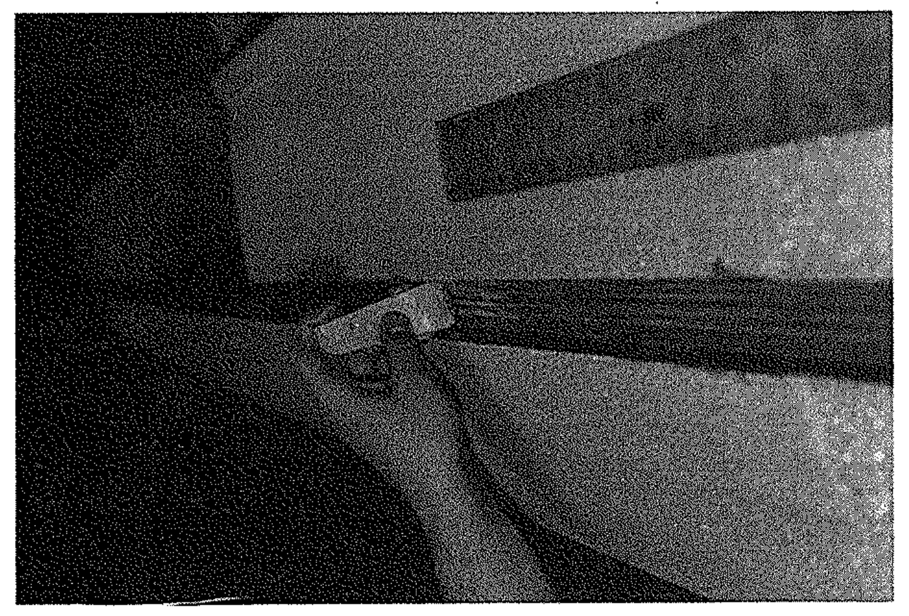
148. Bottom side of canard up on table before disassembling one side of jig.



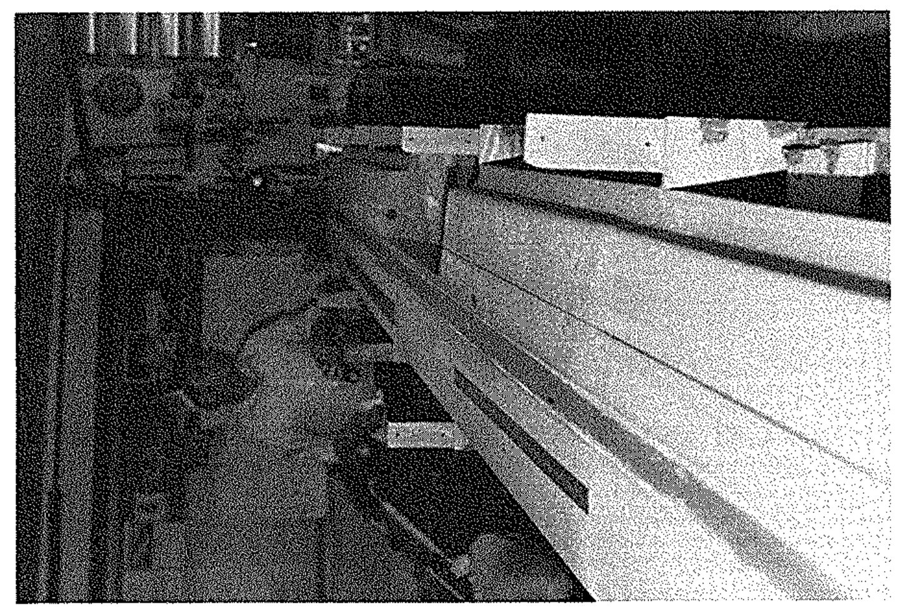
149. Remove jig half and carefully trim shear web edges flush with foam surface.



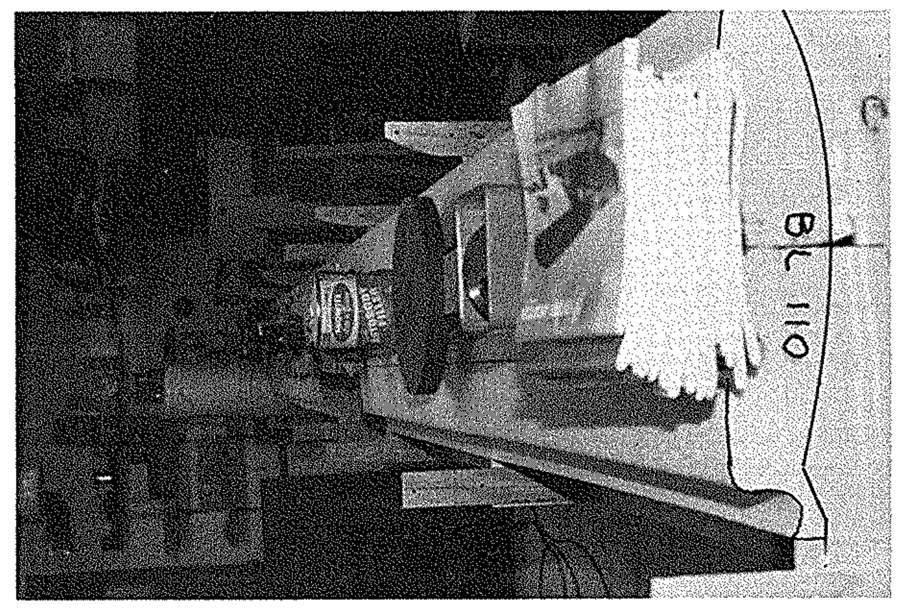
150. Pulling out first 'S' glass strand to fill bottom spar trough. Note a plywood dam with gray tape for release has to be placed in center section between BL+20 to BL-20 for spar cap.



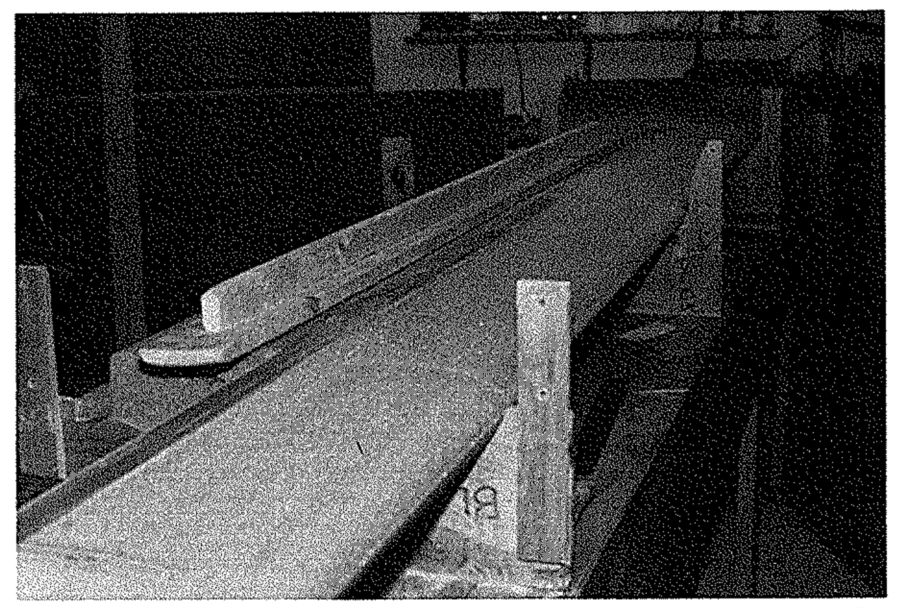
151. Squeegee out 'S' glass about every 8 to 10 strands or less.



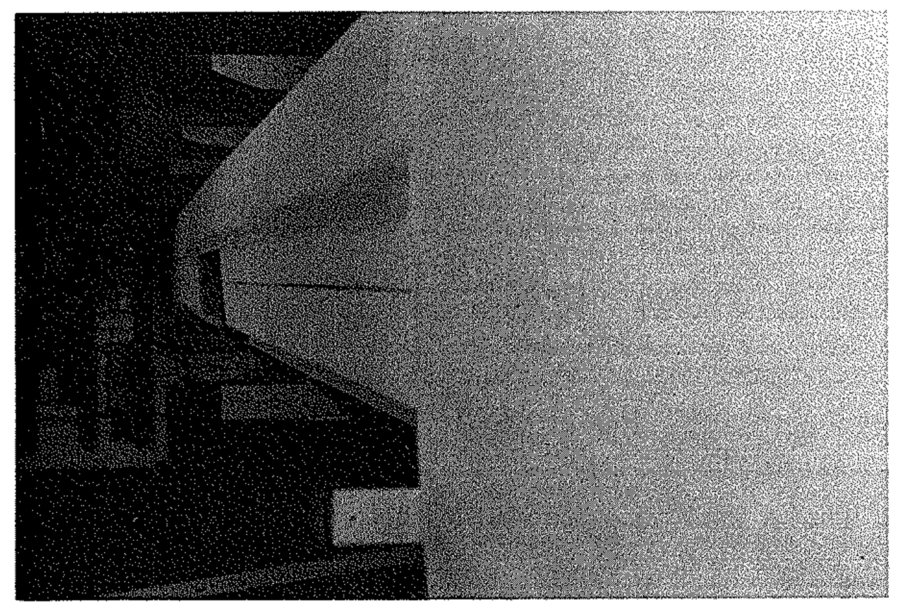
152. Peel ply spar cap.



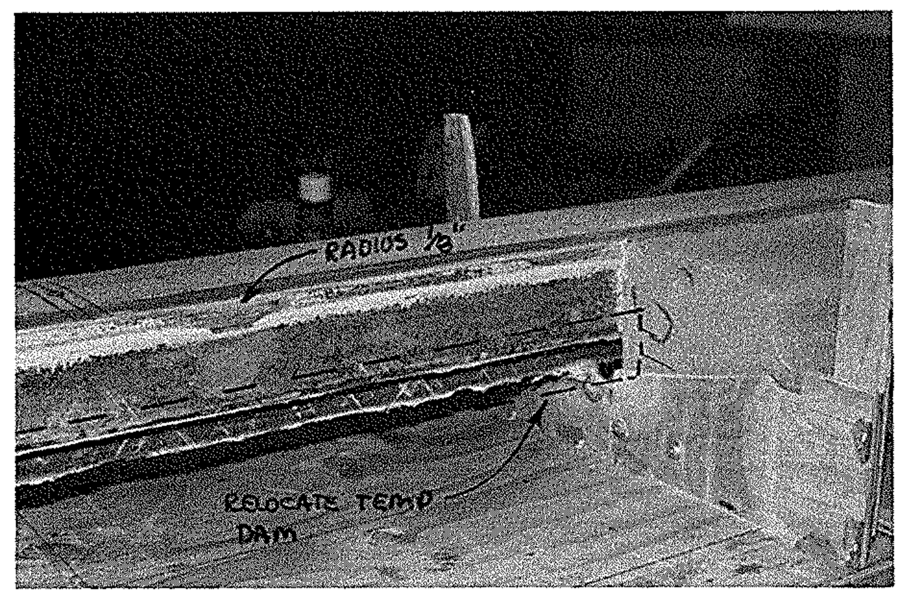
153. Lay straight board on spar cap and weight as shown while curing. Support under side of cores to guard against binding from weight.



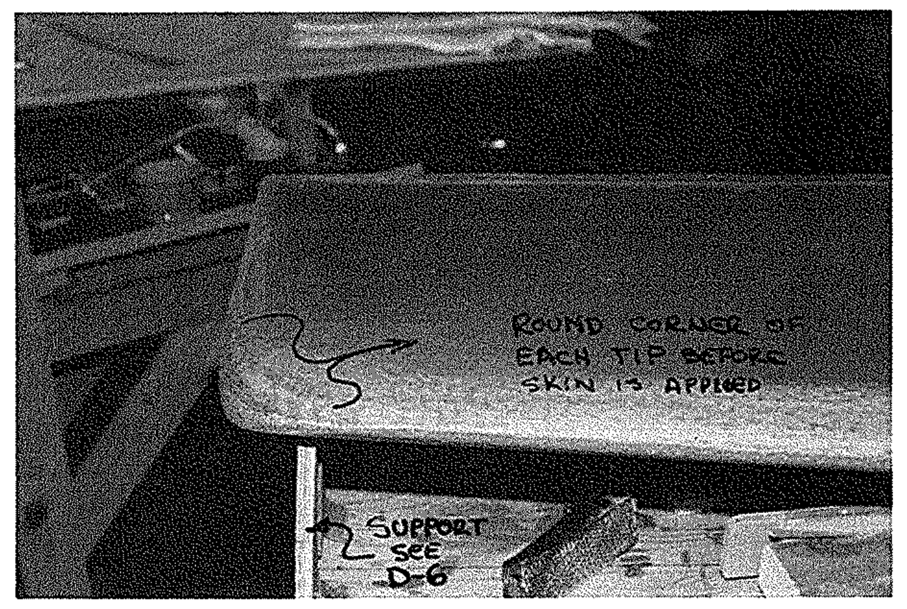
154. Carefully sand cores smooth, fill any dents in foam with scrap pieces of foam and 5 min. epoxy.



155. Preparing bottom foam surface for skin. Note all foam throughout aircraft is slurried before glassing.

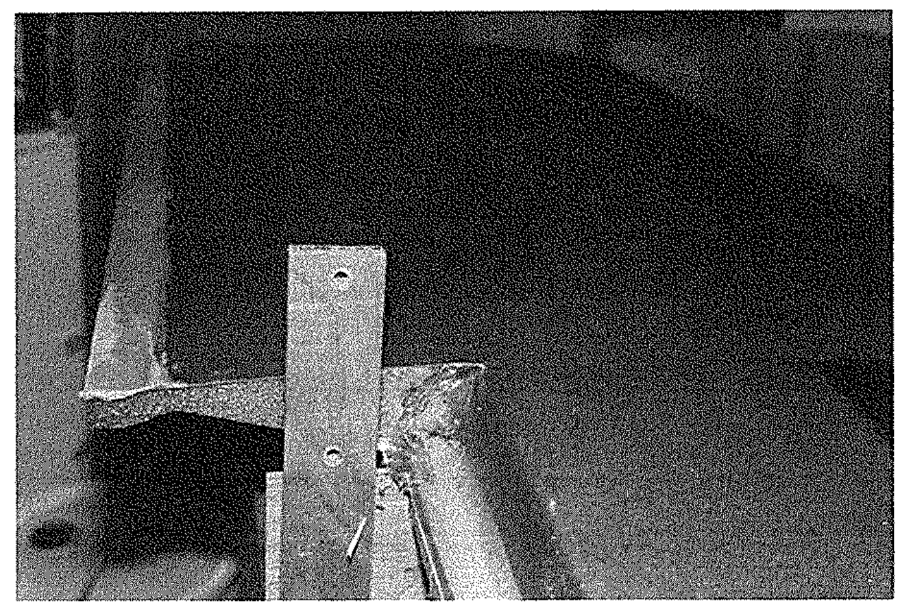


156. Centersection BL+20 to BL-20 after spar cap installation and temporary dam removed. Relocate dam to aft side of top spar cap trough before bottom skin layups begin. Radius CORNER OF BOTTOM SPAR CAP 1/8".

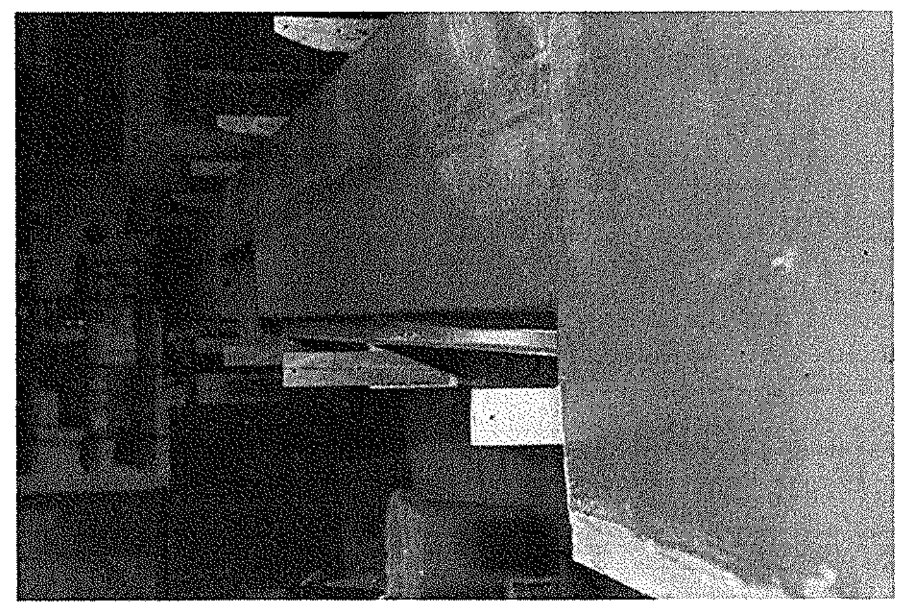


157. Round leading edge corner of canard tips.

158. Centersection BL+20 to BL-20 after bottom skin is placed.



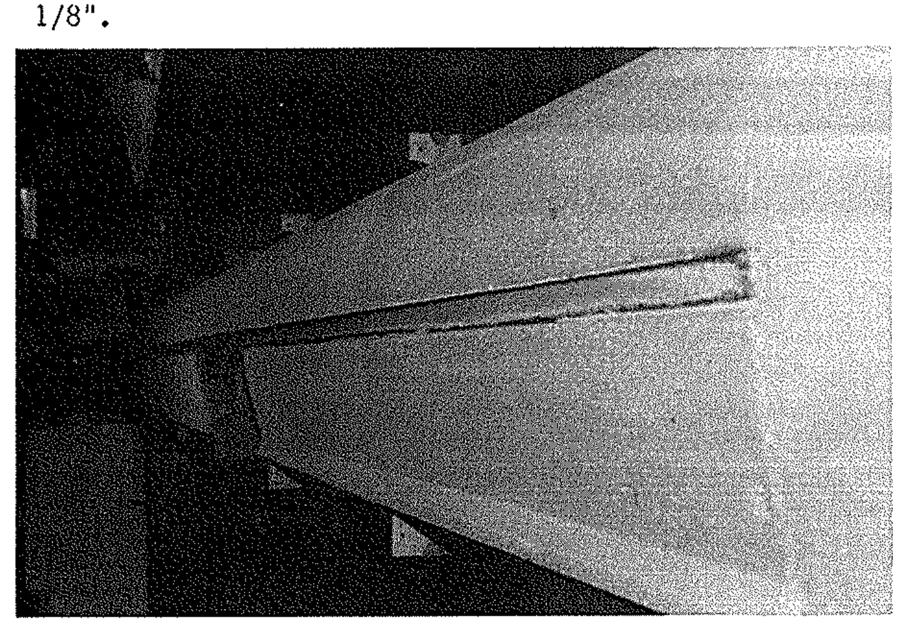
159. Fill trailing edge with Dry Micro.



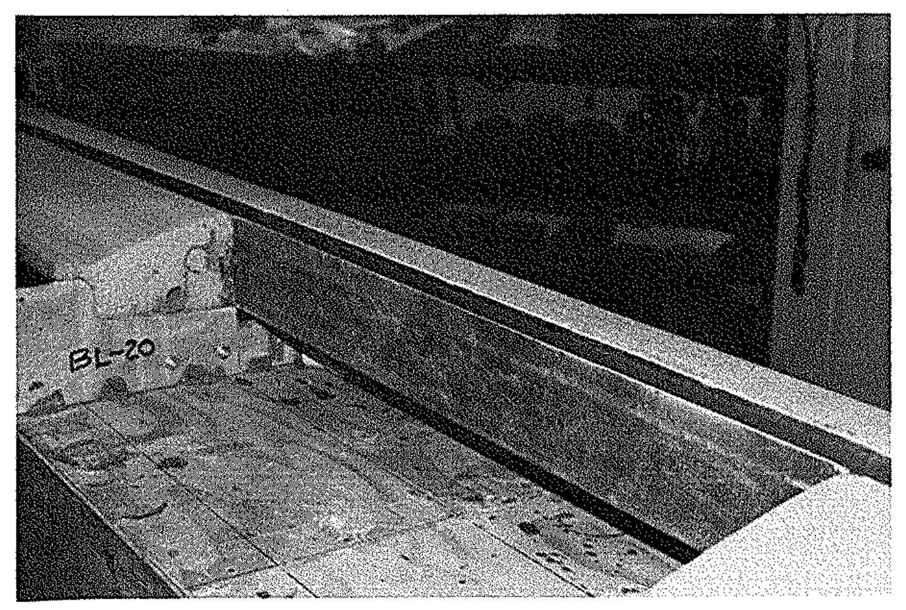
160. Bottom Side of Canard after skin layups.

161. Dry Micro in trailing edges.

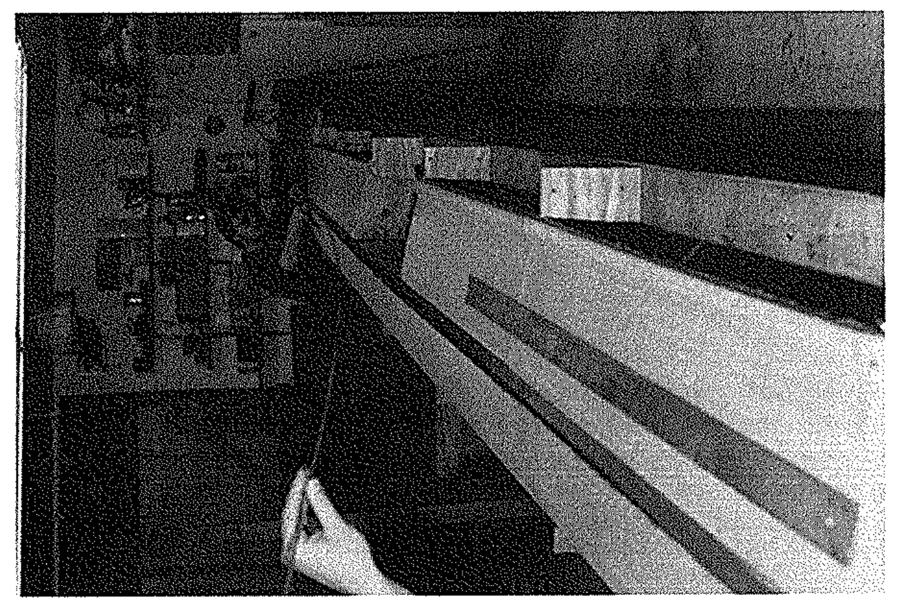
162. Reattach jig piece with Bondo on glass skin after curing and turn canard over.



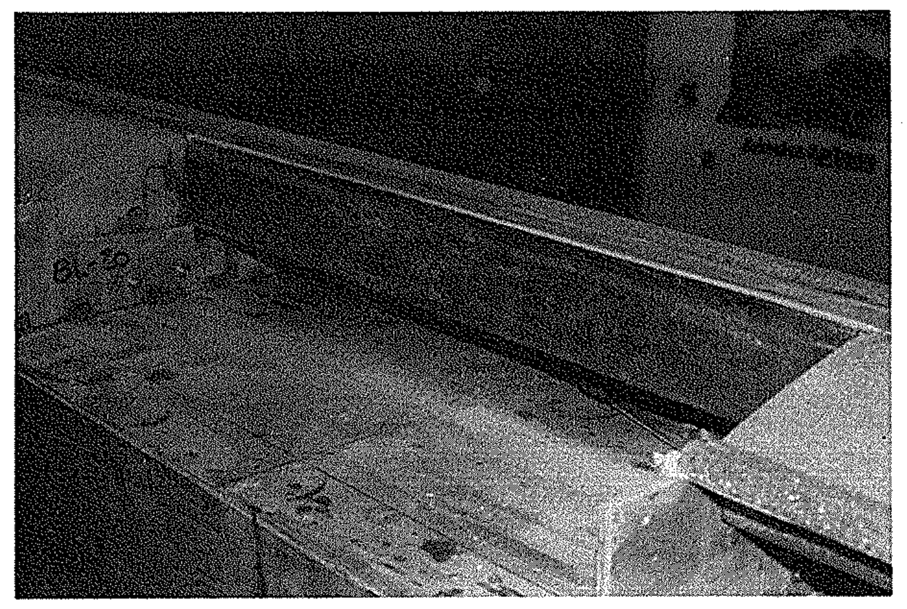
163. Top Spar Cap trough before placing 'S' glass.



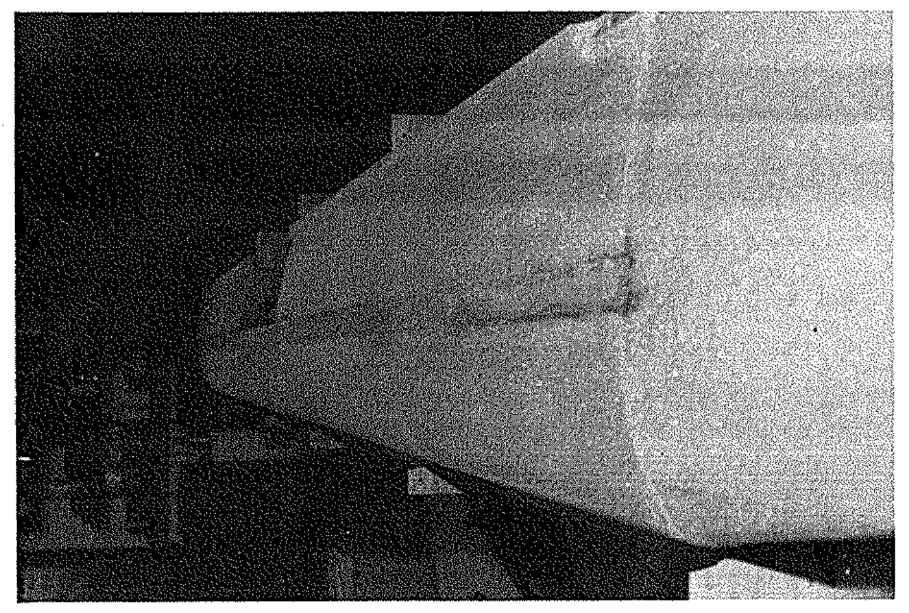
164. Note how bottom skin layups form box for top spar cap. Remove temporary dam required for bottom skin.



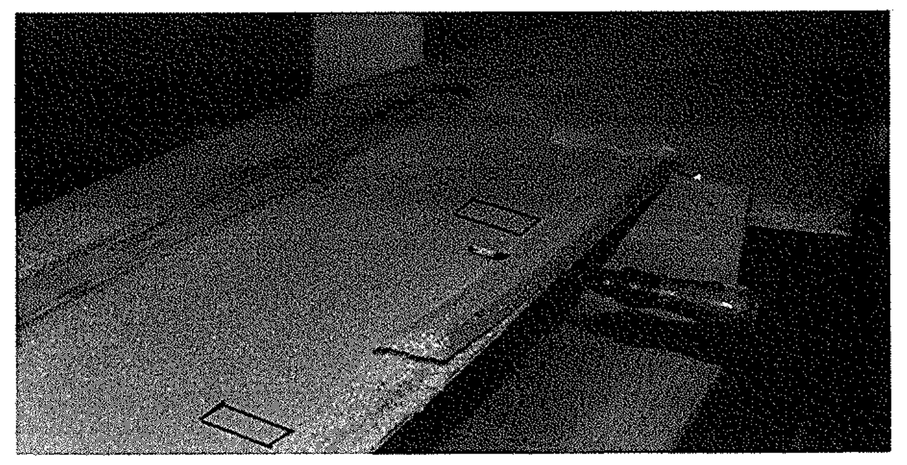
165. Lay in 'S' glass one by one until trough is full.



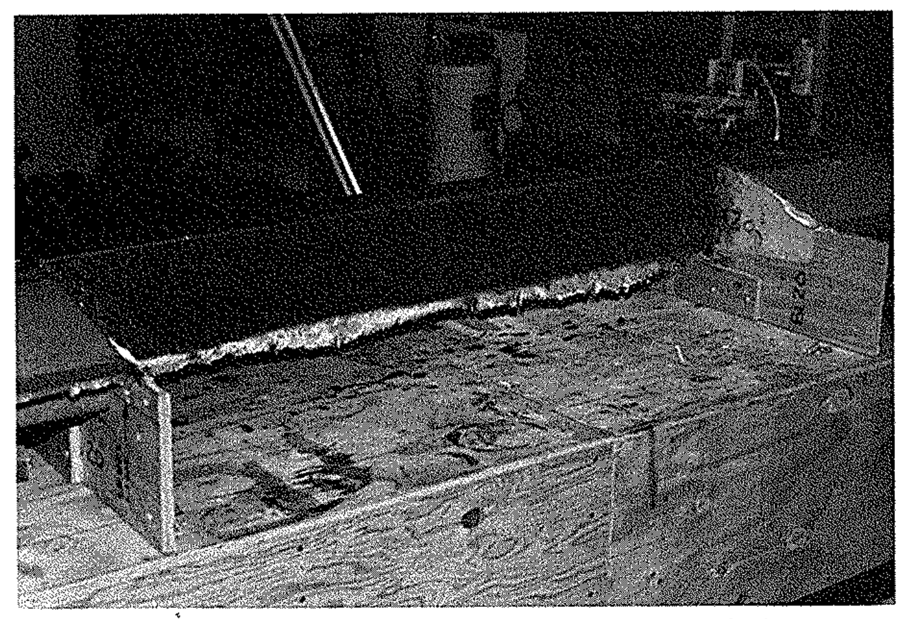
166. Centersection BL+20 to BL-20 after spar cap placement.



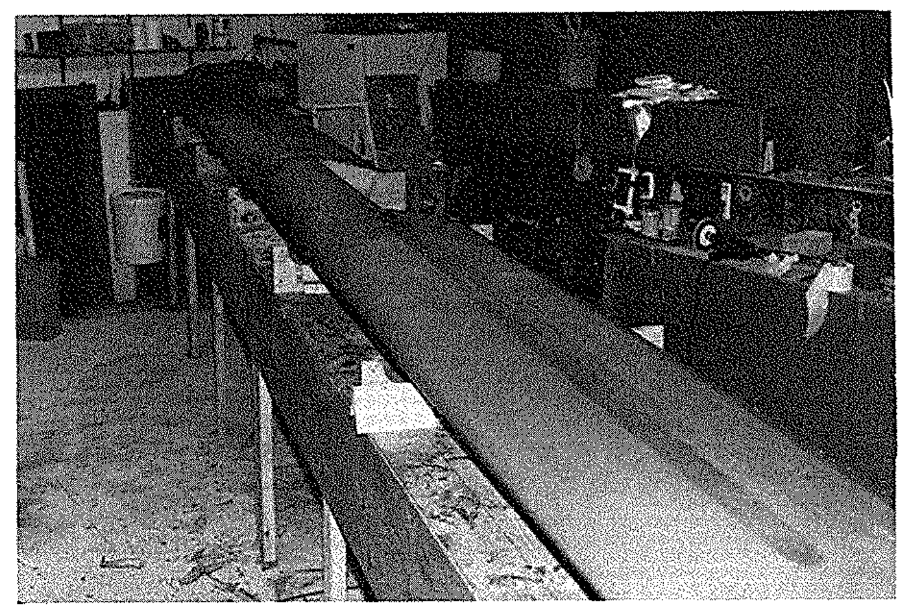
167. Top of canard after spar cap placement.



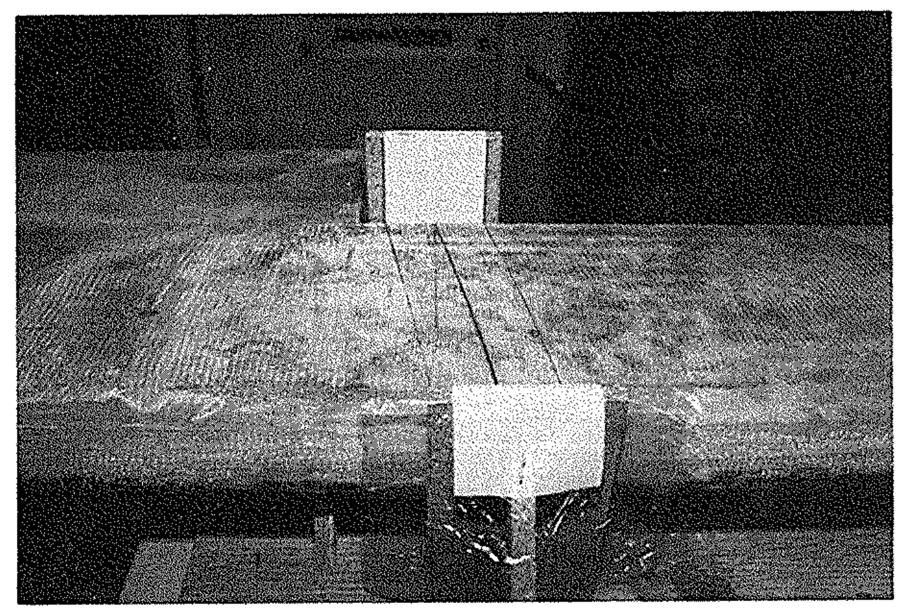
168. Note outline of location for high density foam required to anchor CS-3. Install high density foam before doing top skin layups. Cut T.E. FOAM as shown.



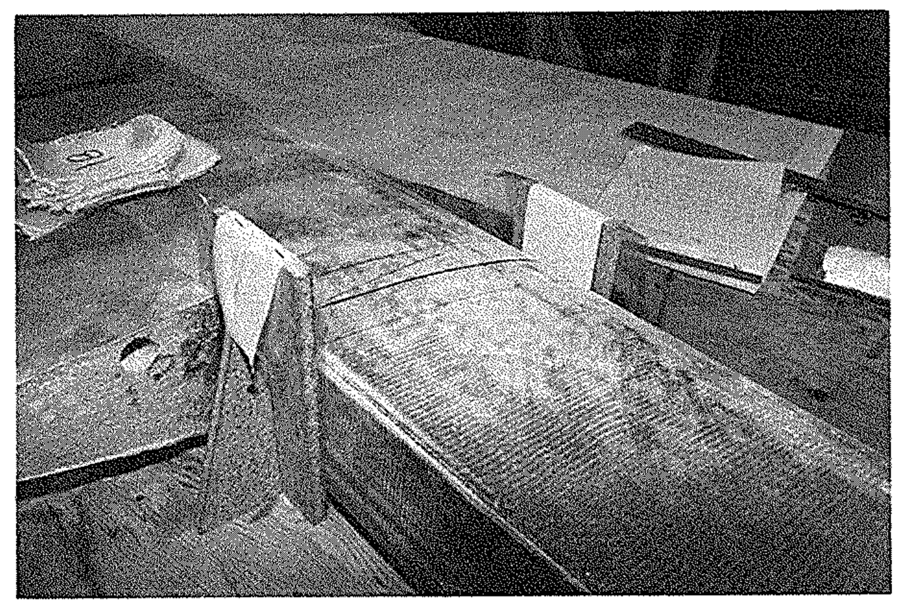
169. (Canard) Extend top skins to bottom of Center Section BL+20 to BL-20.



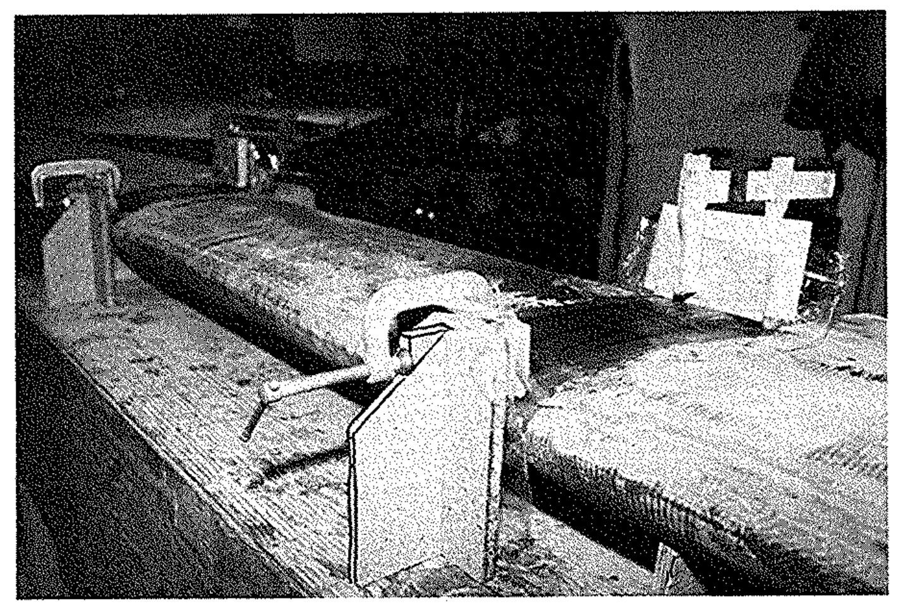
170. Top side of canard skin layups.



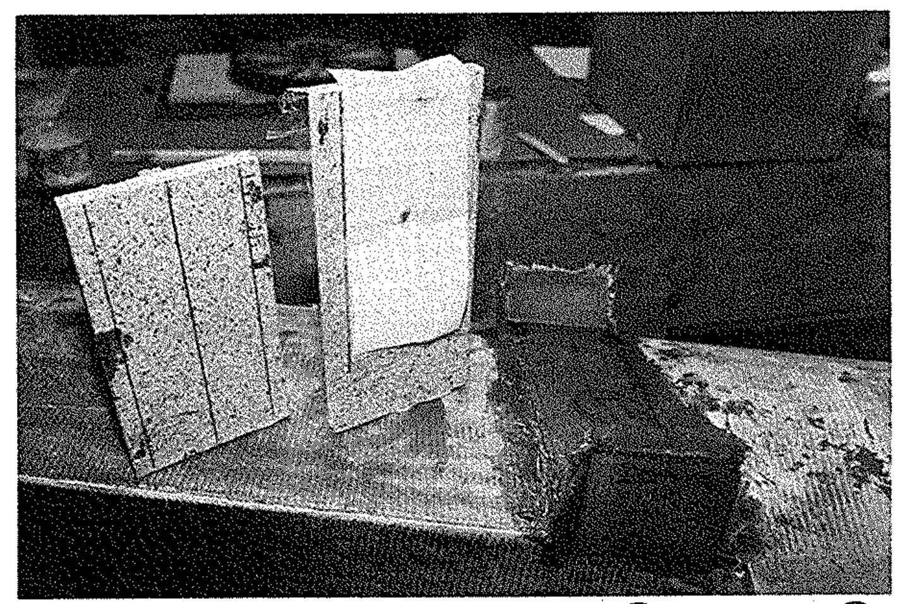
171. Setting to do canard lift tab layups. Note the offset of forward tab to aft tab. See D-25 and D-26.



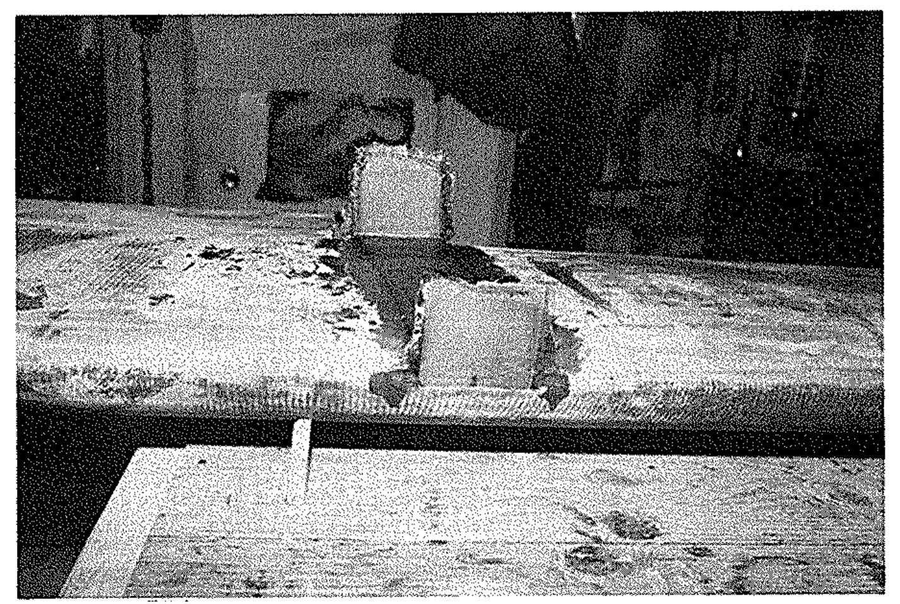
172. (Right lift tabs). Note: Use PEEL PLY to ready surface for later layup.



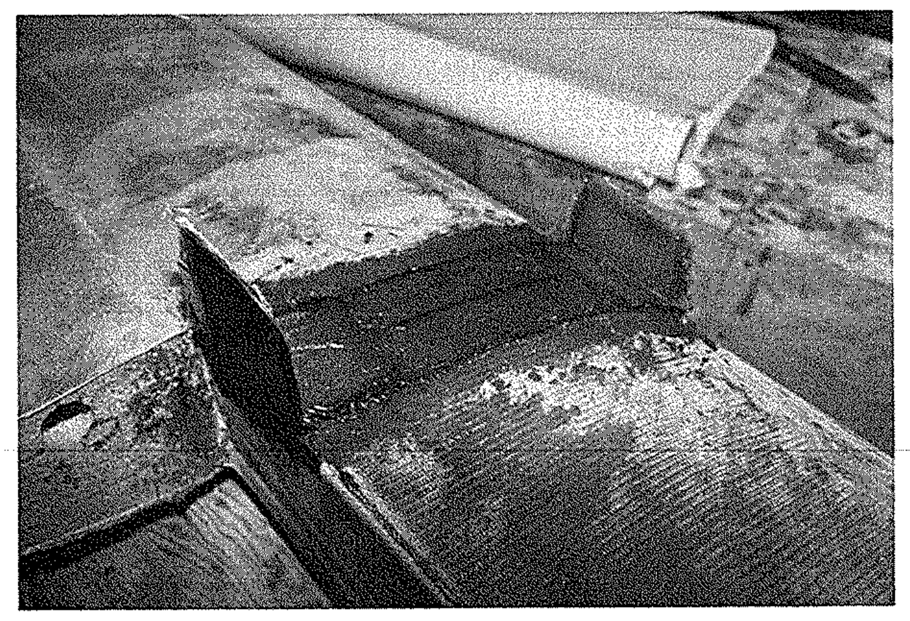
173. Lightly clamp lift tabs after doing layups ⑤, ⑥ and ⑦.



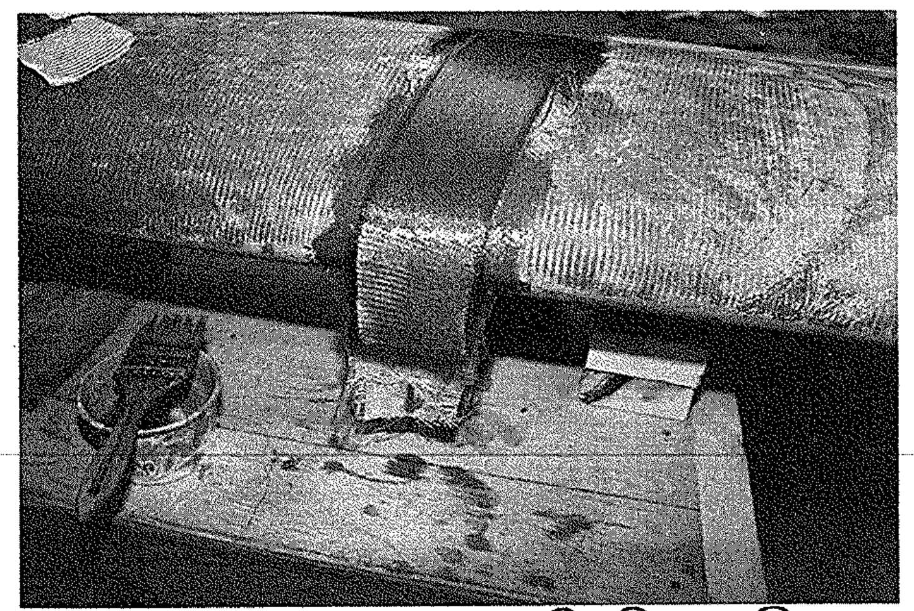
174. Lift tabs and fixtures (layups ⑤,⑥, and ⑦ have cured).



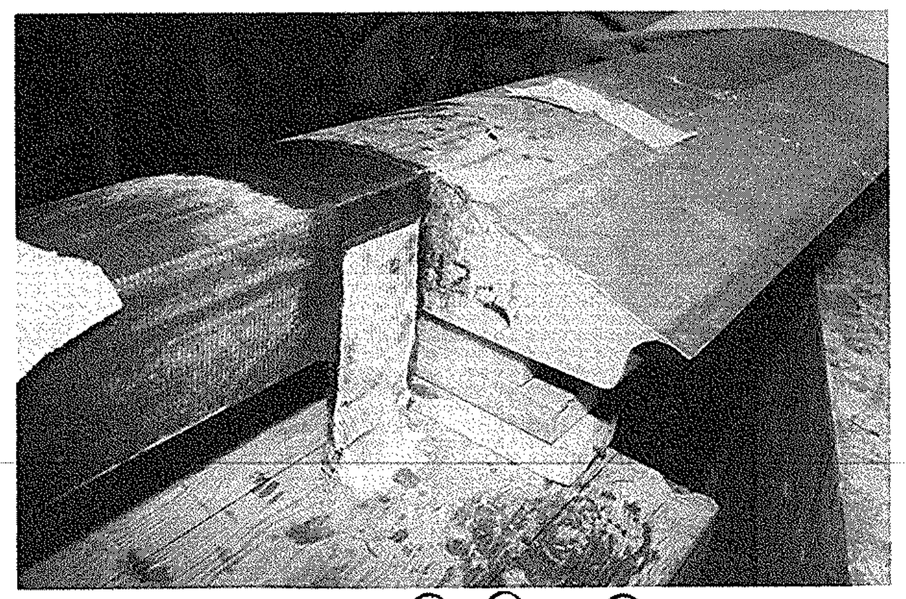
175. Layups ⑤,⑥, and ⑦ on left side. (SEE D-26).



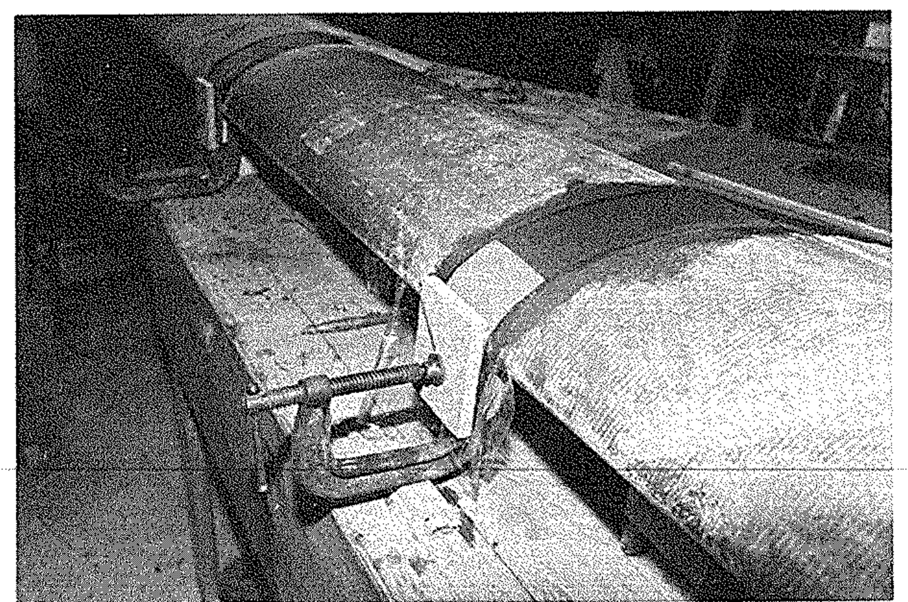
176. Layups ⑤,⑥, and ⑦ on right side.



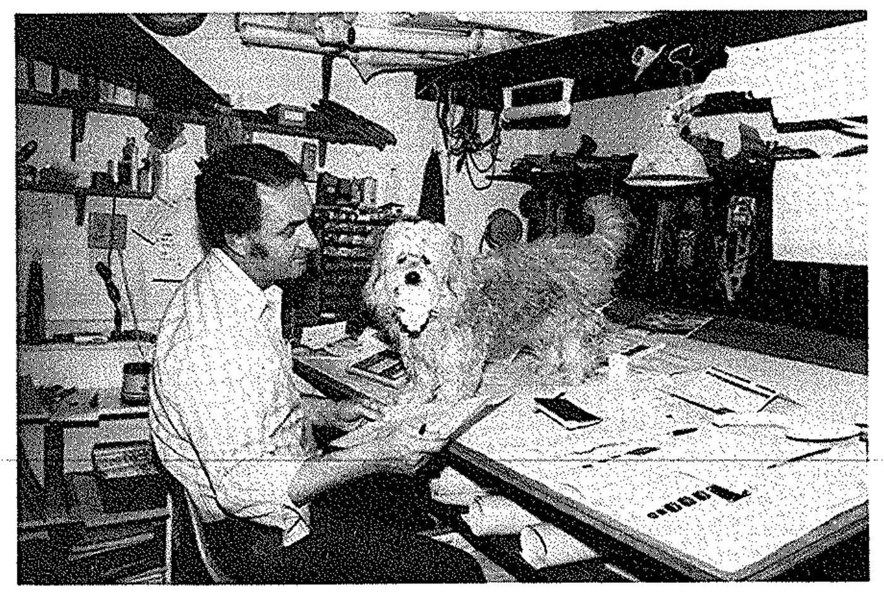
177. Applying lift tab layups ⑧,⑨, & ⑩ on left. Note layup callout numbers are same for both left and right tabs.



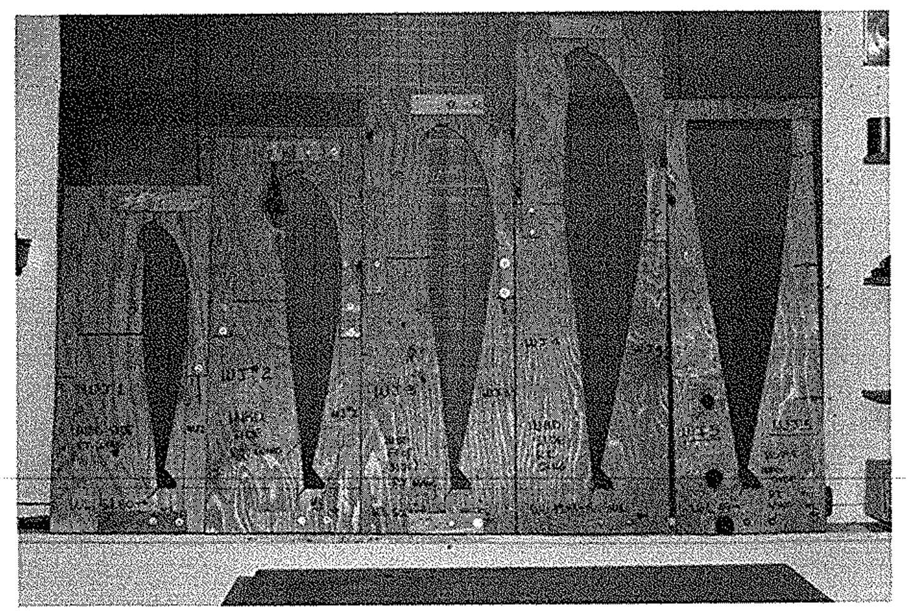
178. Lift tab layups ⑧,⑨, & ⑩ on the right side. NOTE: To more clearly show method, the last BID ply is not wetted out yet in this photo. DO WET OUT PLY.



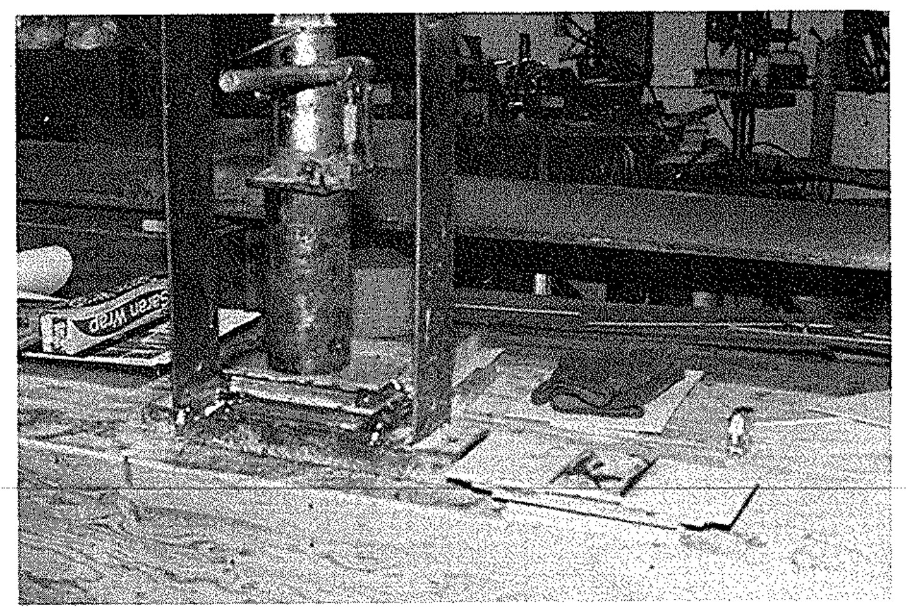
179. Lightly clamp layups ⑧,⑨, & ⑩ at lift tabs. This completes canard work for now.



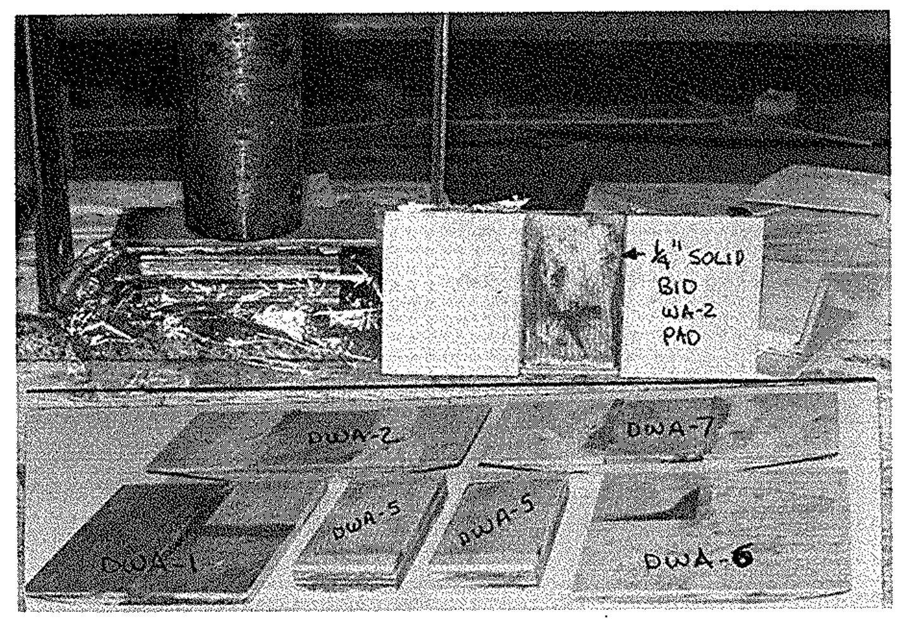
180. Don't forget your FAA paper work. You should apply no later then 4 months before completing aircraft.



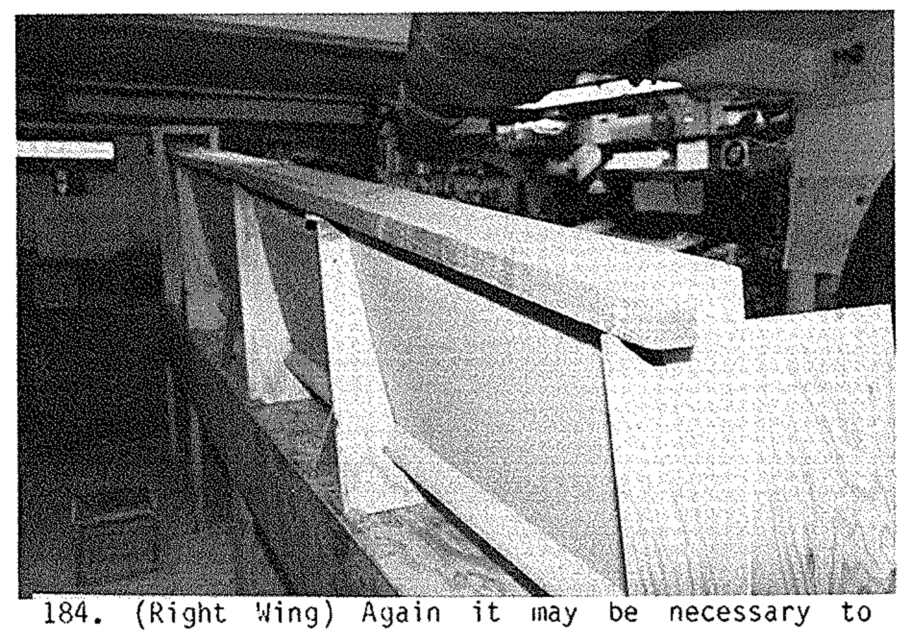
181. Main wing jigs used to construct both left and right wings.



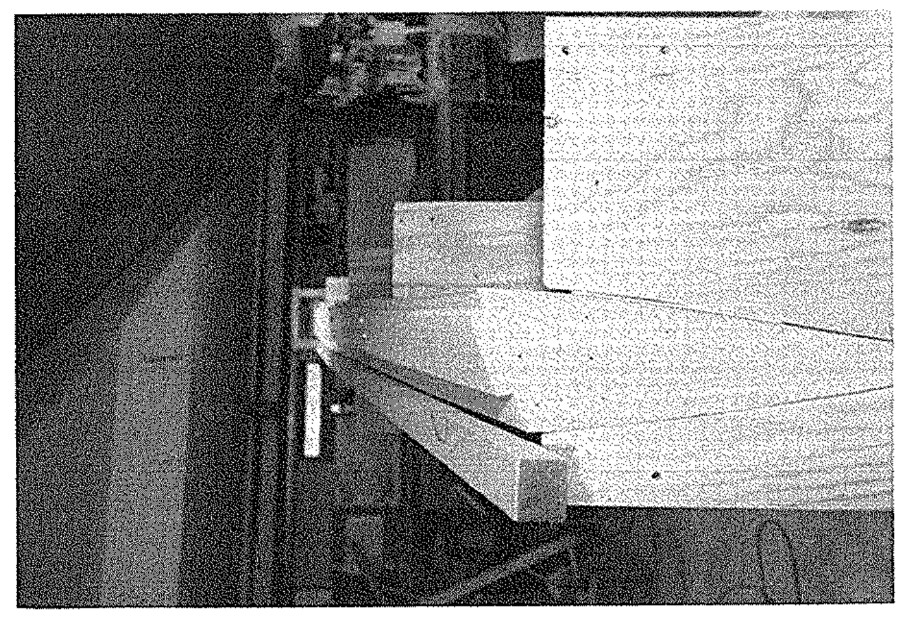
182. Use press to make plywood hard points.



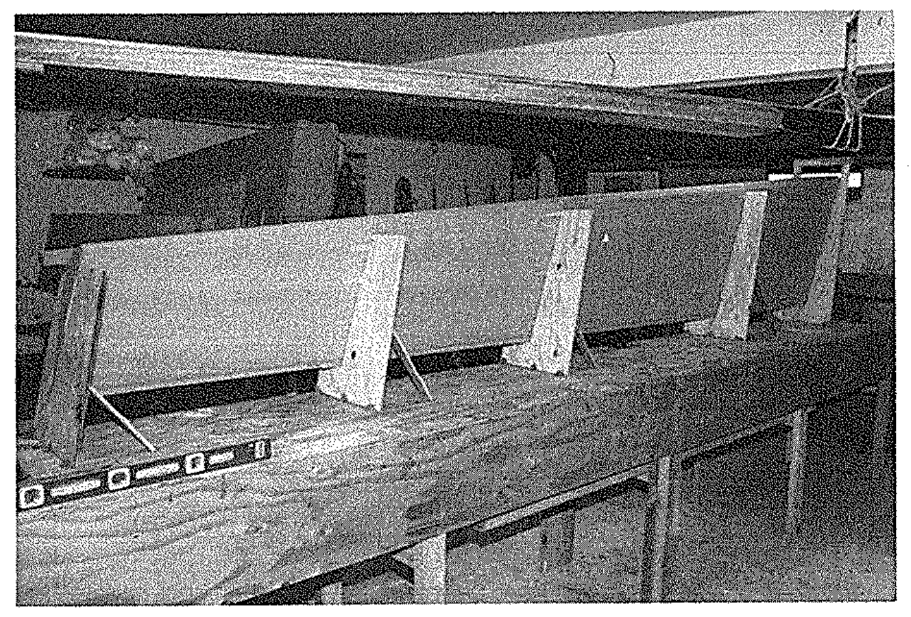
183. Some of the hard points used in centersection spar and main wings spars.



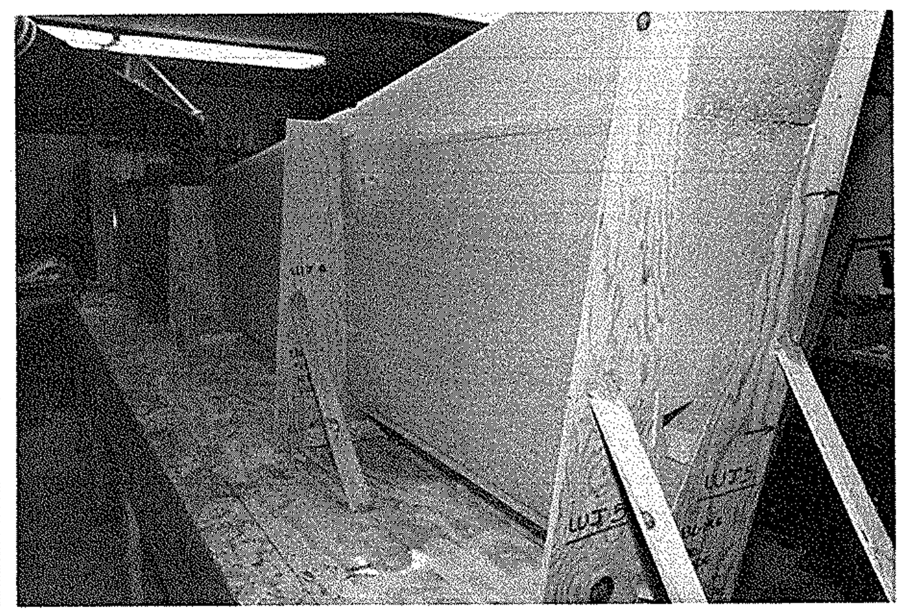
184. (Right Wing) Again it may be necessary to attach cross piece to jigs to wedge against for straightening the foam cores. Mirco all foam cores together. See photo 209.



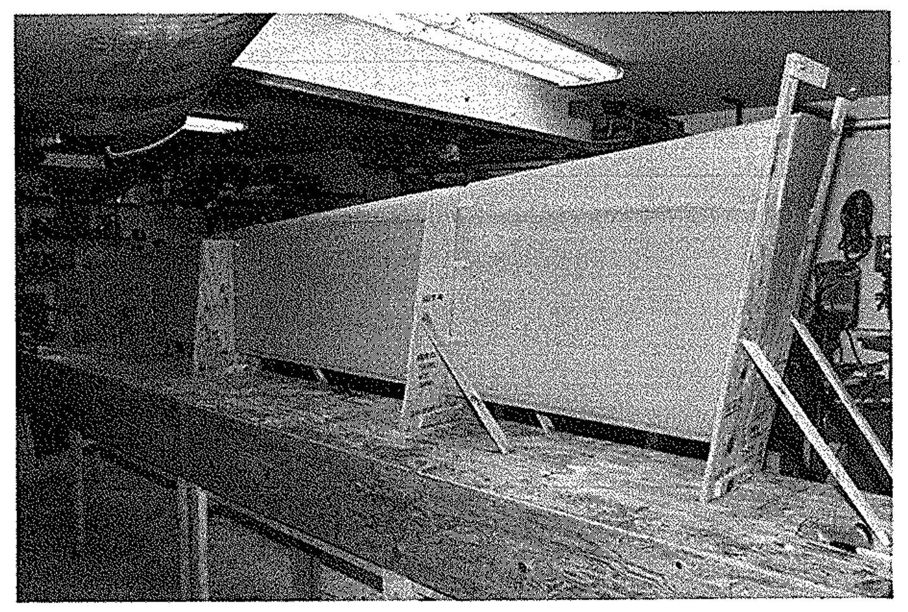
185. (Right Wing) Different View of Photo 184.



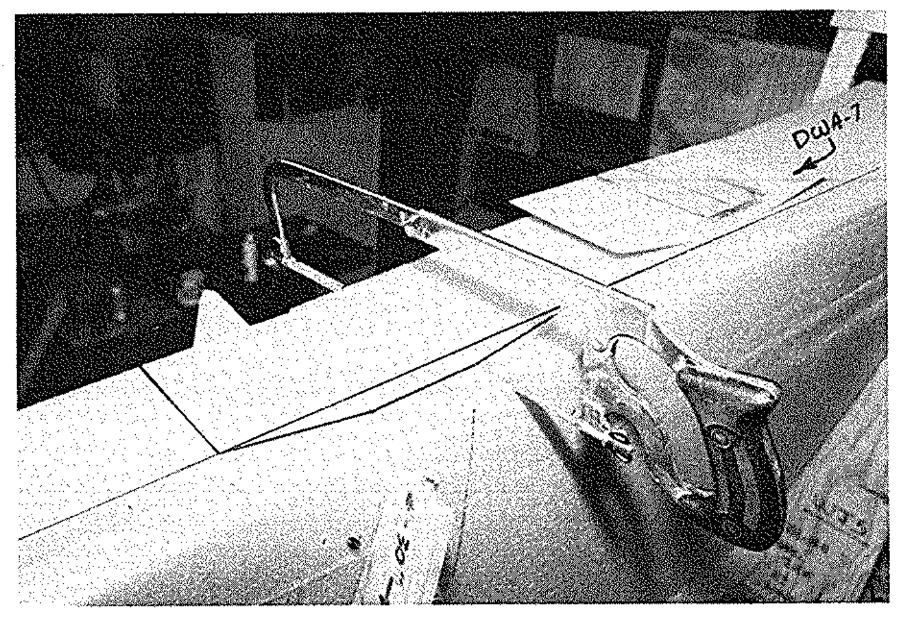
186. (Right Wing) Shows how wing jigs are laid out. See D-28 for spacing.



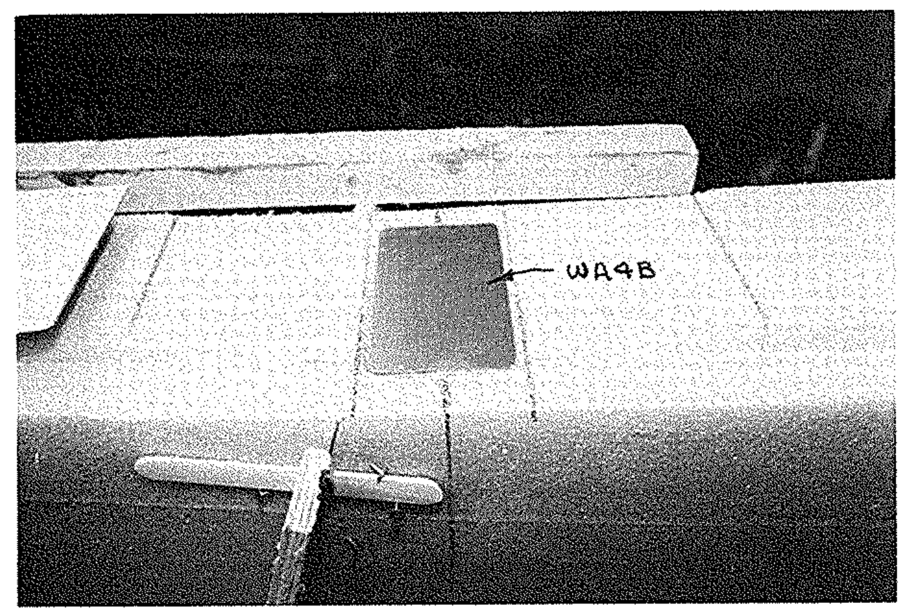
187. (Right Wing) Braces required to hold jigs. Bondo jigs and brace to table.



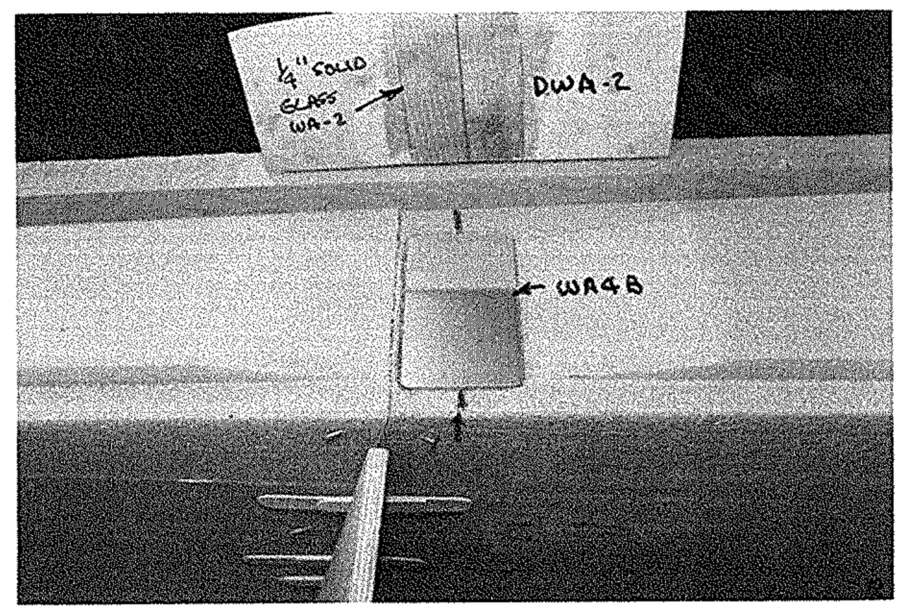
188. Continue of Photos # 186 and 187.



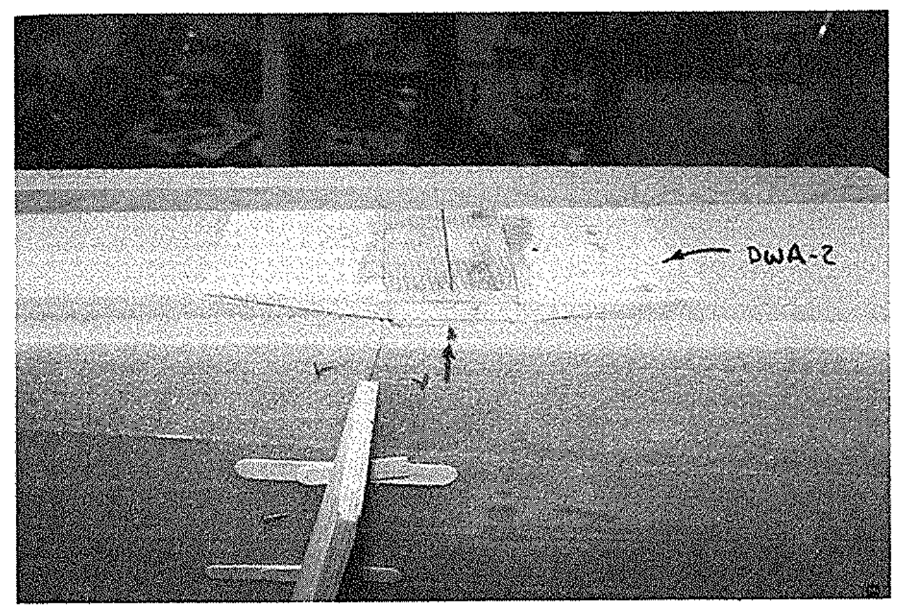
189. Left Wing. Using dimension from wing construction drawings D-28, 29 and 30 layout hardpoints. Use saw to cut away foam, as in the case of DWA-7.



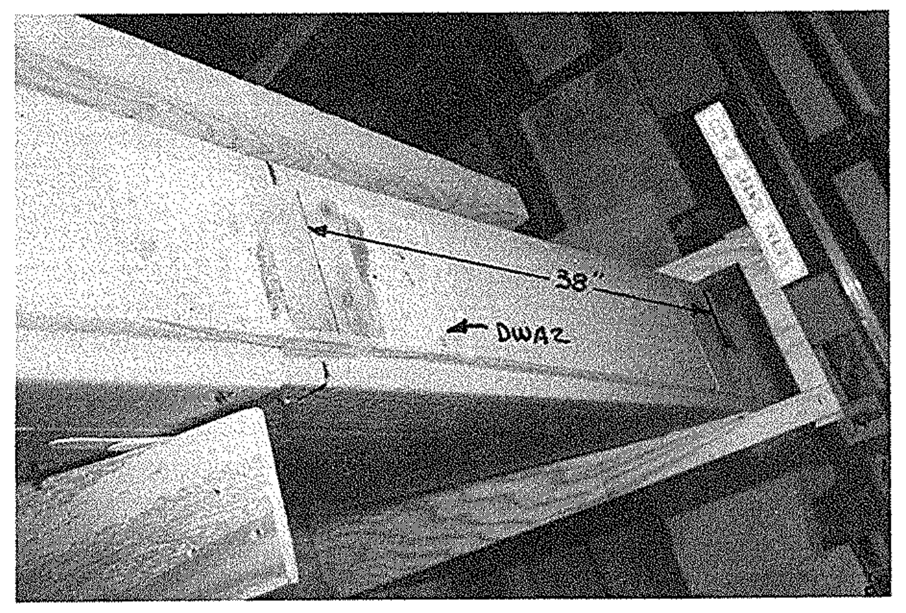
190. Left Wing. Carefully measure location of WA-4B ALUMINUM insert - recess foam 1.8" on micro WA-4B in place.



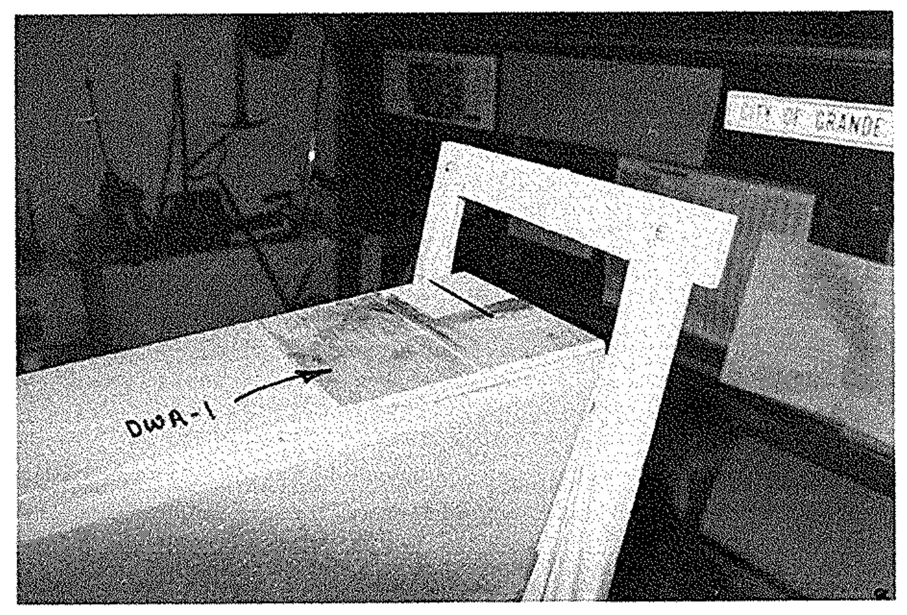
191. Right Wing. Installing WA-4B in right wing - recess 1/8" and MICRO in place.



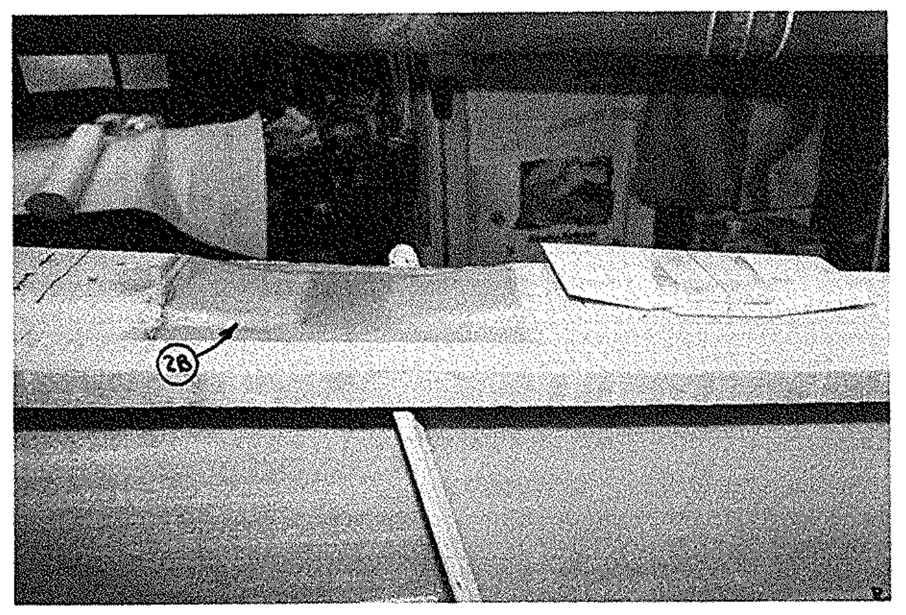
192. Right Wing. Check fit of hardpoint (SWA-2) before doing layups. Note use of sticks between jig and foam to secure.



193. Right Wing. Shows layout of both hardpoints. (DWA-1 and DWA-2).

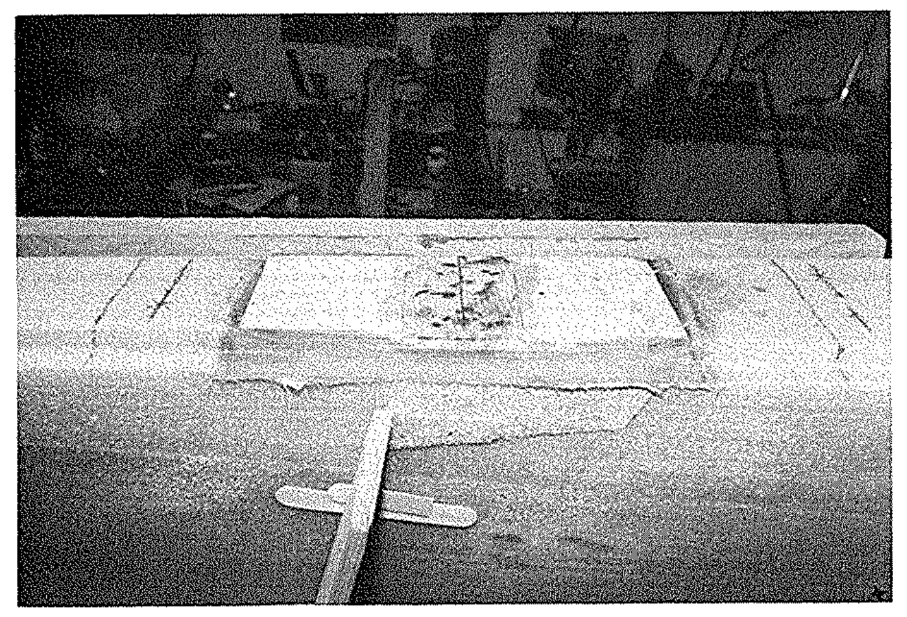


194. Right Wing. Check fit of DWA-1.

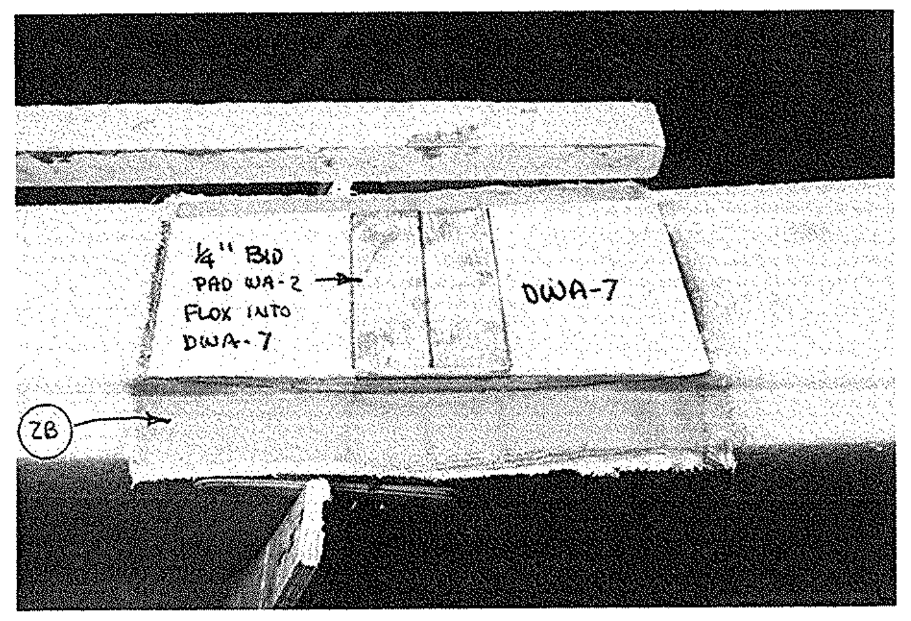


195. Right Wing. Completed layup #2B.

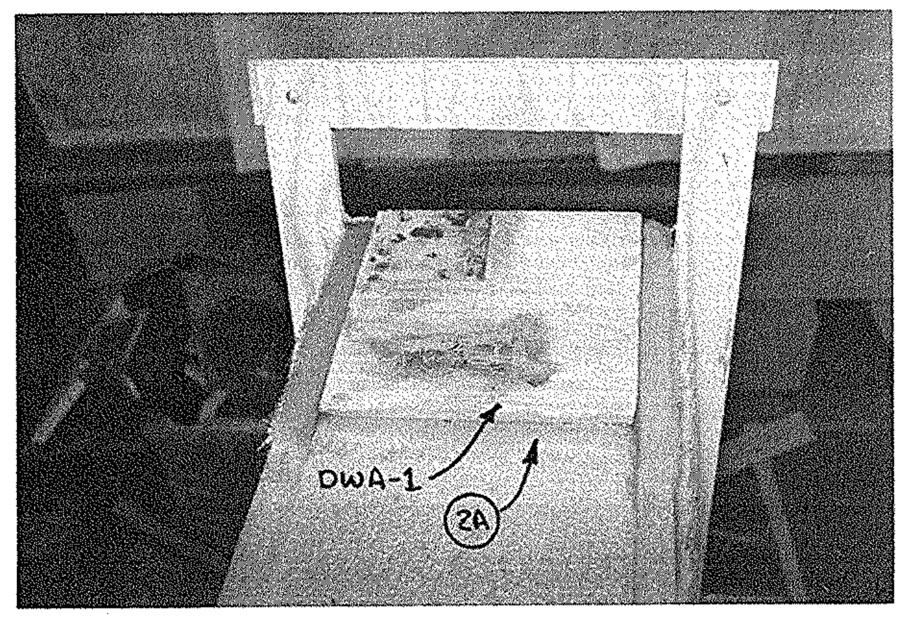
196. Right Wing. Preparing to do layup #2A.



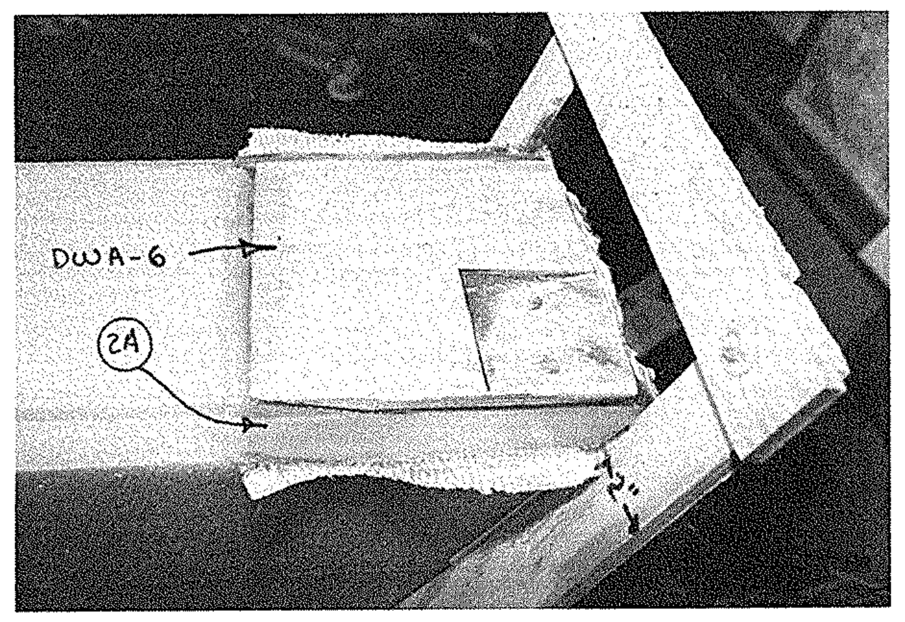
197. Right Wing. While layup #2B is still wet - WET FLOX DWA-2.



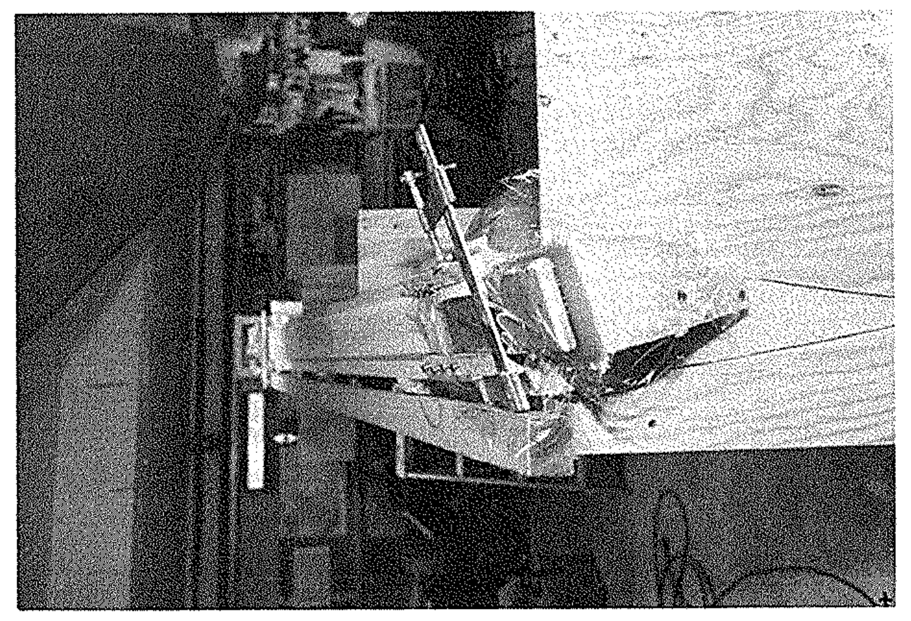
198. LEFT Wing. Shows #2B layup and DWA-7 flox in place.



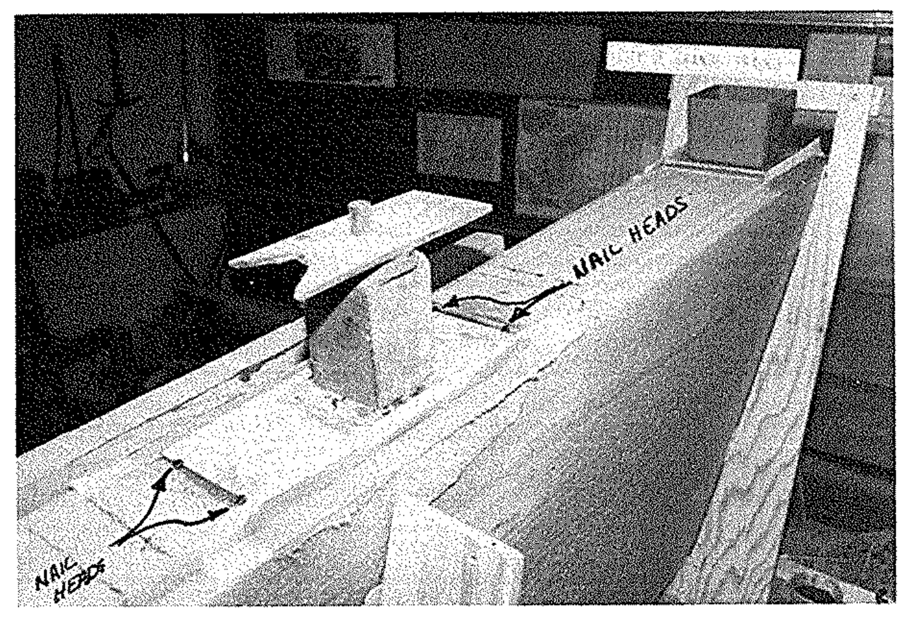
199. Right Wing. Placement of layup #2A and DWA-1, flox in place.



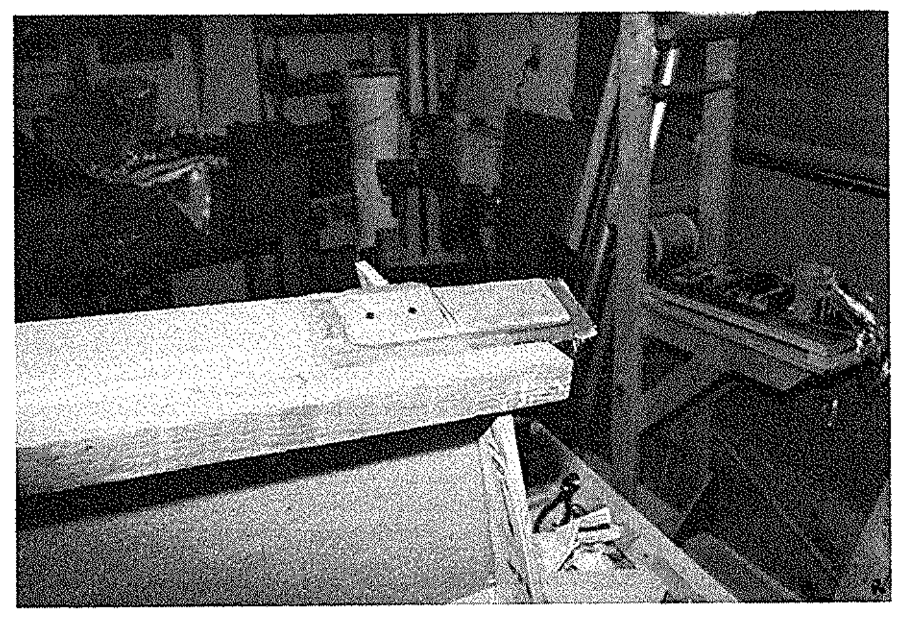
200. LEFT Wing. Placement of layup #2A and DWA-6.



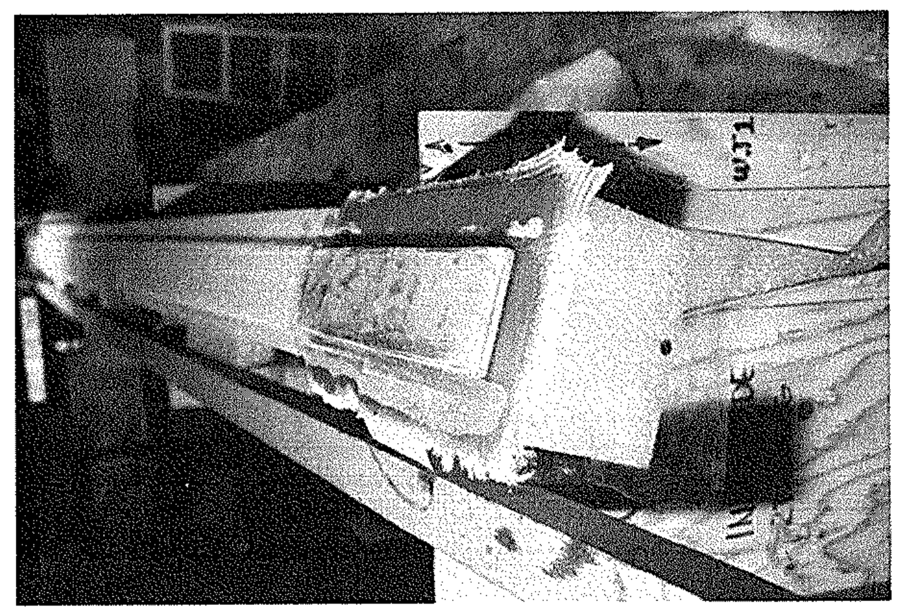
201. Right Wing. Placing layup #2C and DWA-3. (SEE Photo #204 for added information).



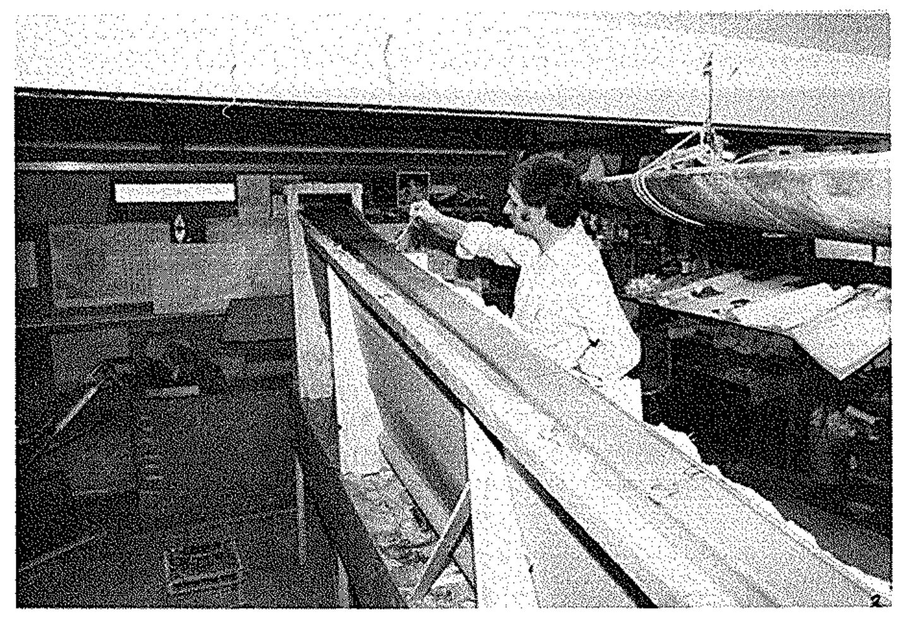
202. Right Wing. Weight hardpoint and allow cure. Note use of nails to hold alignment may be necessary. Remove nails after cure.



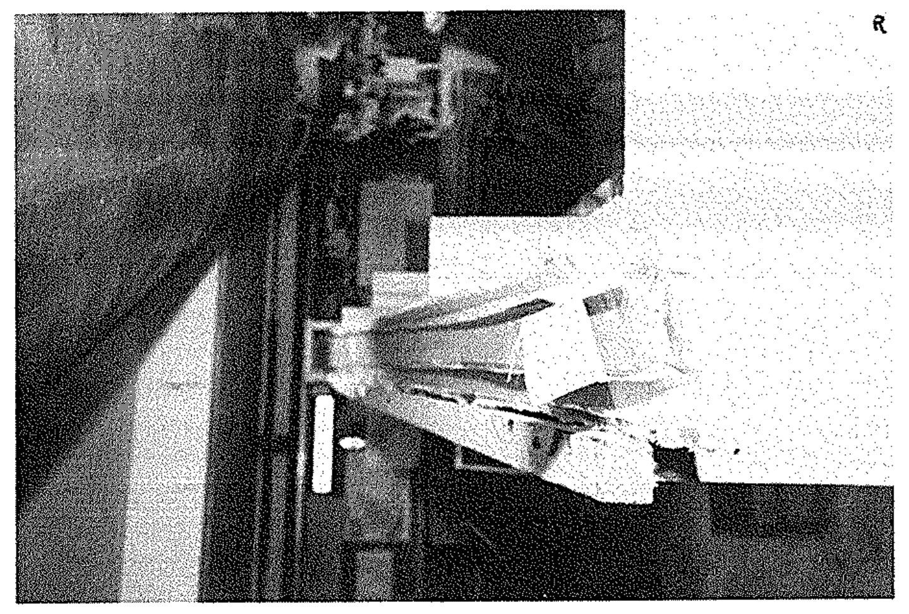
203. Right Wing. DWA-3 at wing tip.



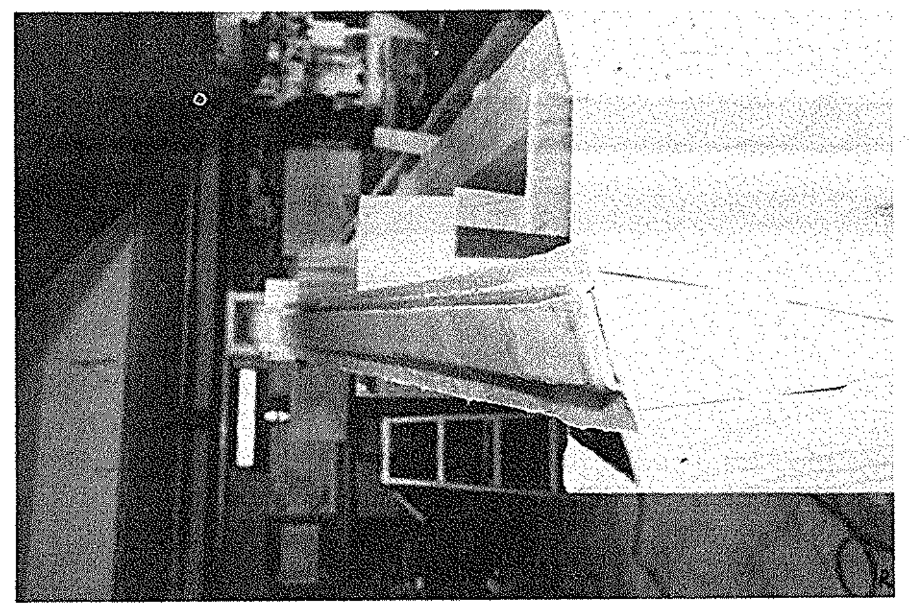
204. LEFT Wing. Note the need to build a temporary foam support under DWA-3 for layup #2C.



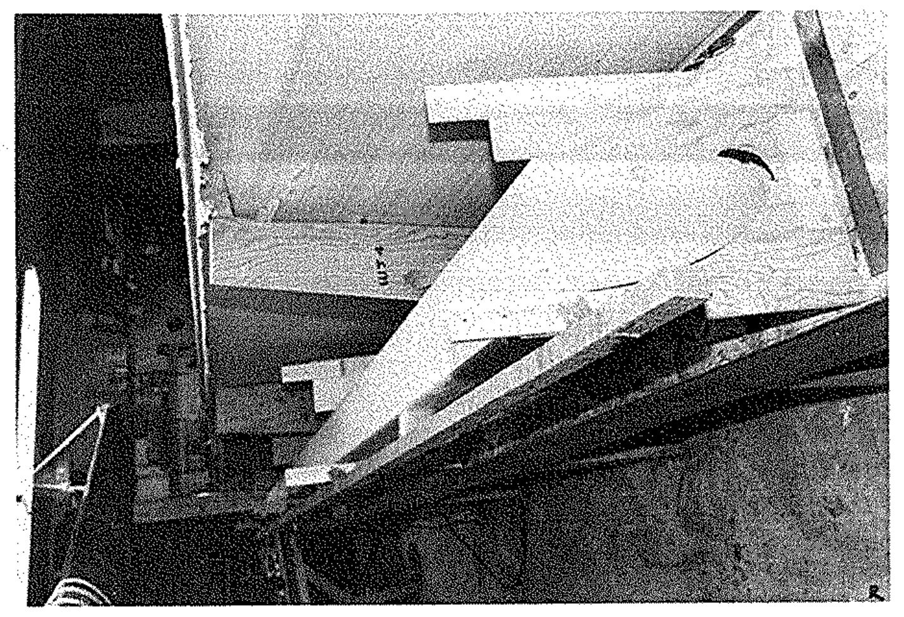
205. Right Wing. After hardpoints have cured remove any alignment nails and peel ply and do layups #3A, #3B and #3C.



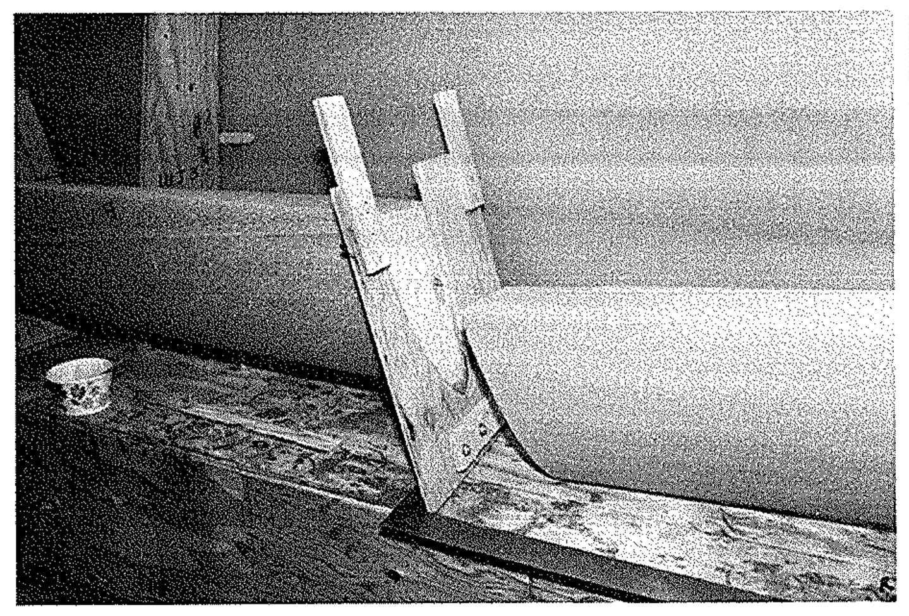
206. Right Wing. Peel ply shear web.



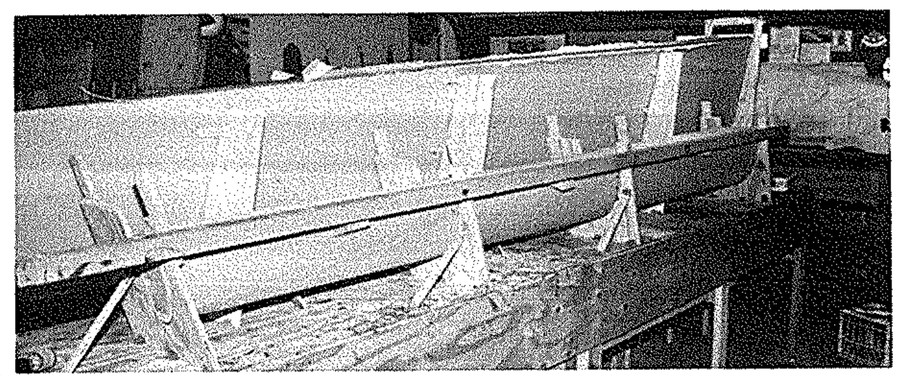
207. Right Wing. Completed aft shear web with peel ply removed.



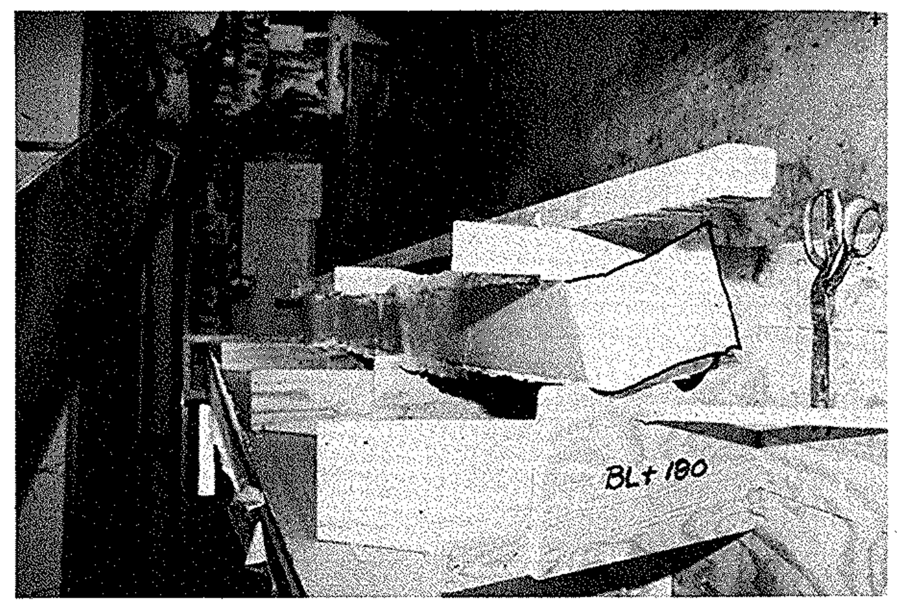
208. Right Wing. Setting up forward foam cores for shear web layups.



209. Right Wing. Apply heavy coat of micro to each foam mating face and push together. Remove any excess micro.

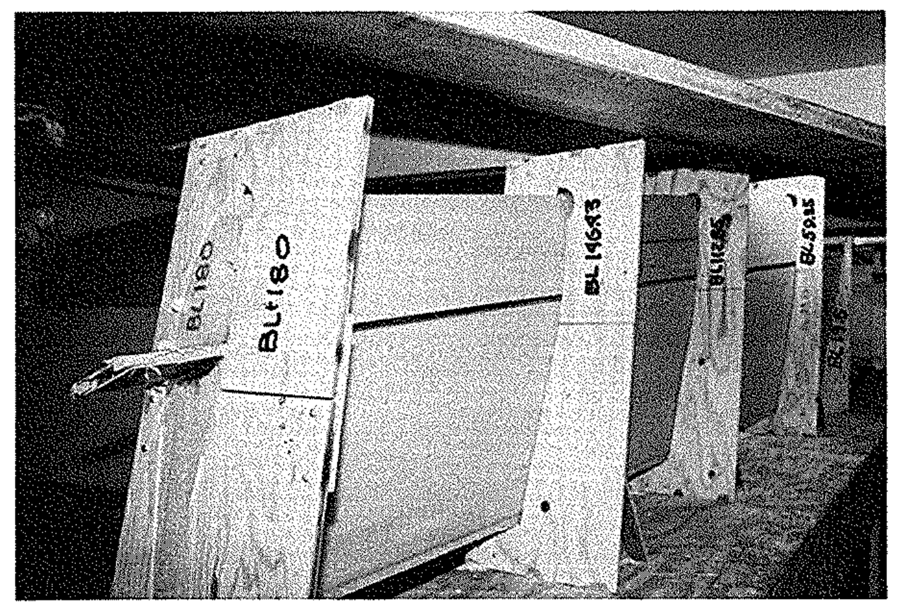


210. Right Wing. Make sure foam cores are straight before glassing.

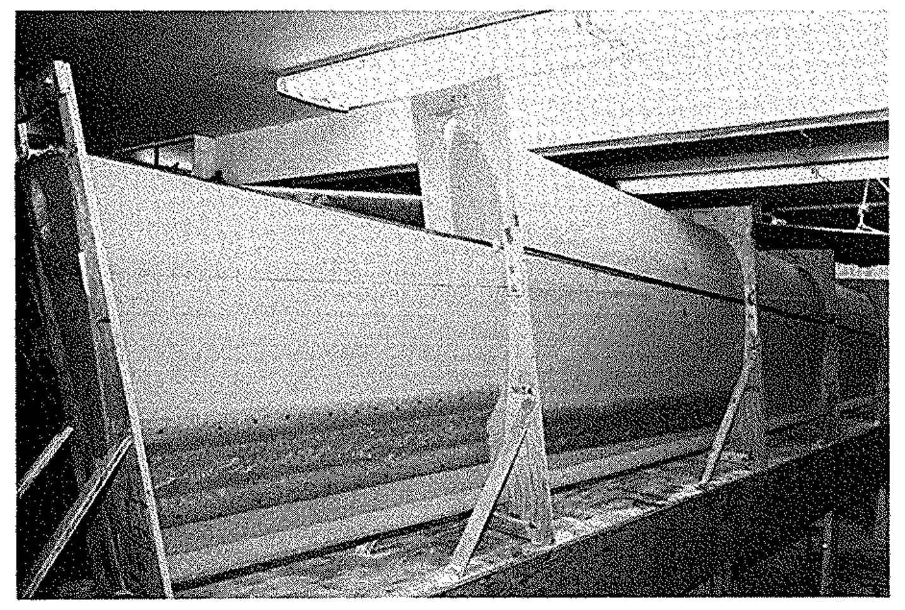


211. Right Wing. FORWARD shear web layup 4 . Note extra length of dry glass left to provide shear web for spar stub. (SEE Section G-G D-31).

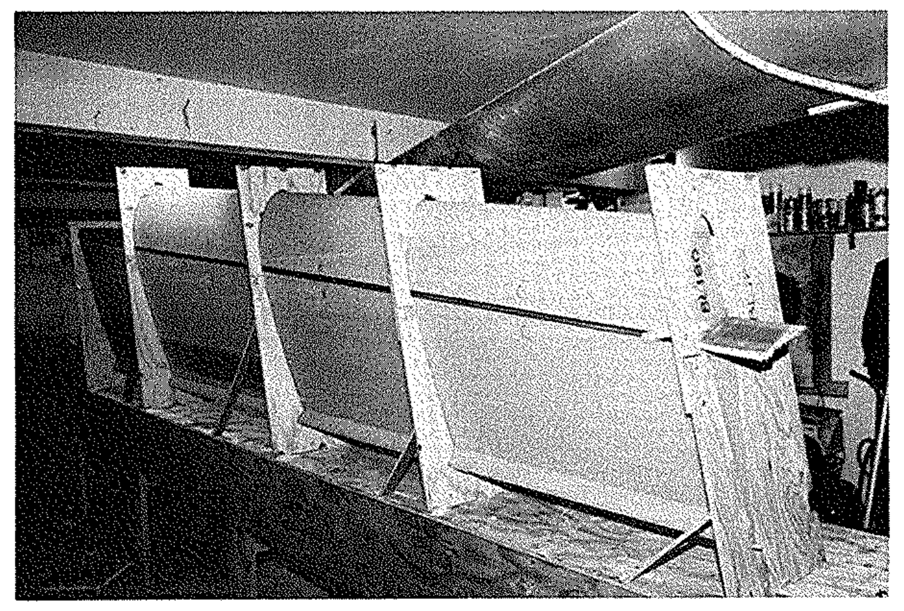
212. Trim edge of shear web.



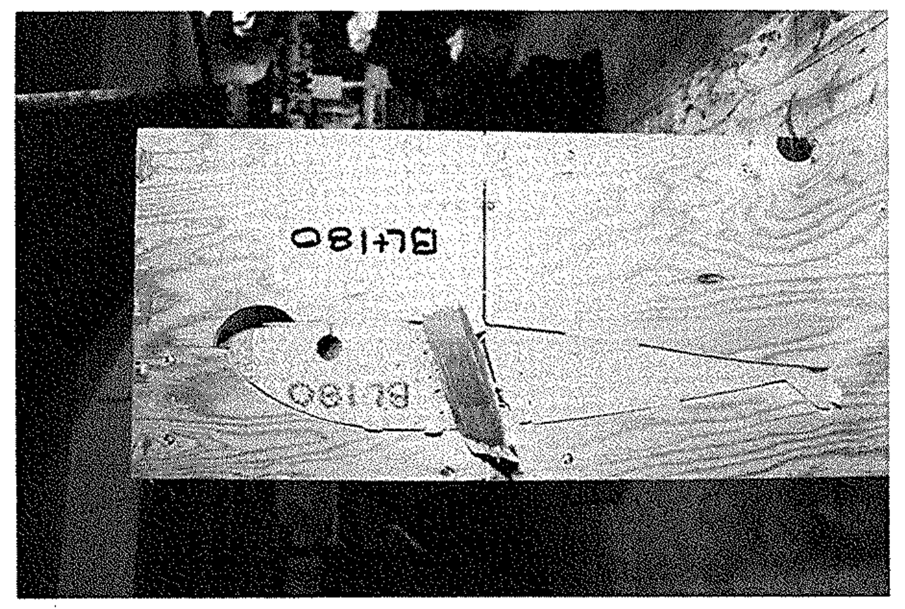
213. Right Wing. After shear web has cured, remove peel ply. Micro leading edge cores back to rest of wing. Wet out dry portion of layup ④ at spar stub.



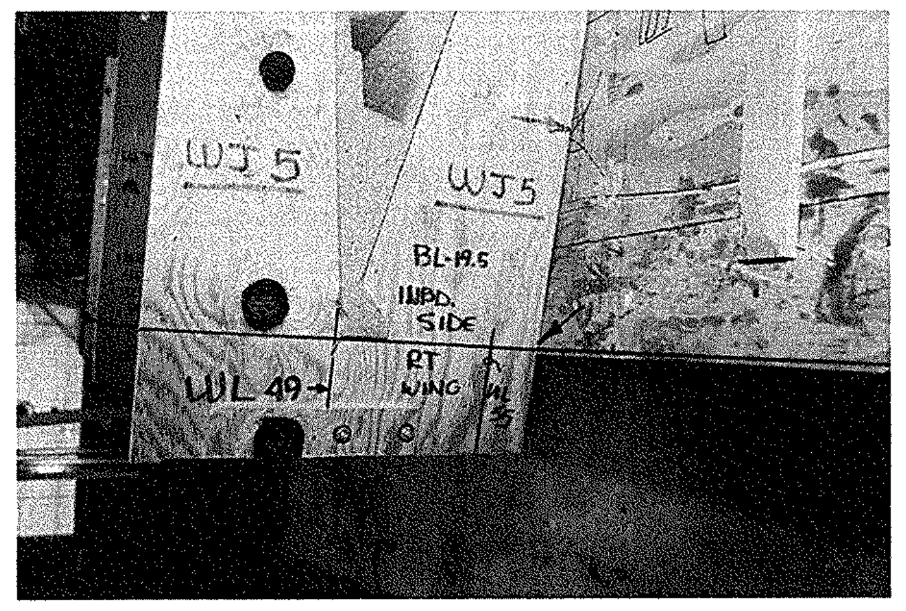
214. Right Wing. Different angle.



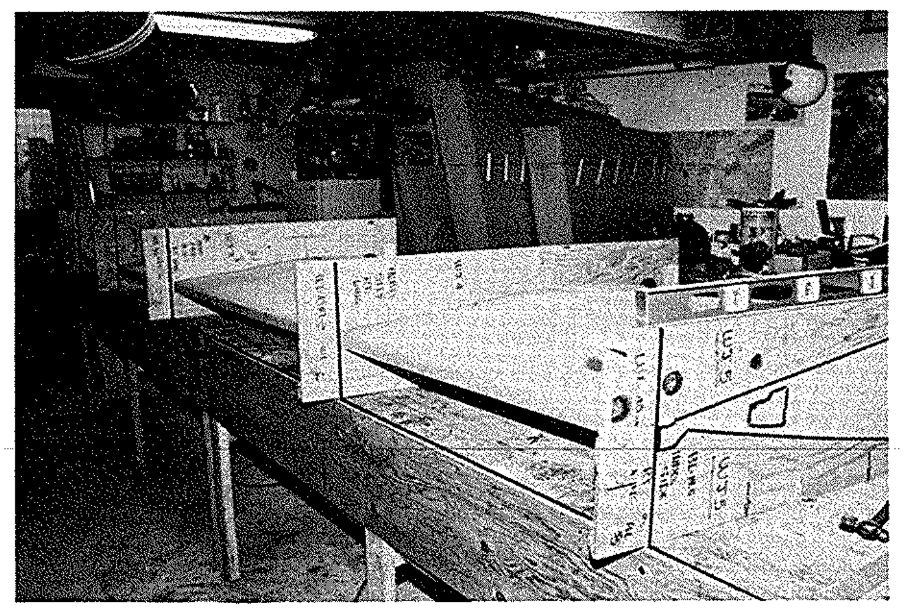
215. Right Wing. Note: Extra glass of layup ④ is now wetted in place on spar stub.



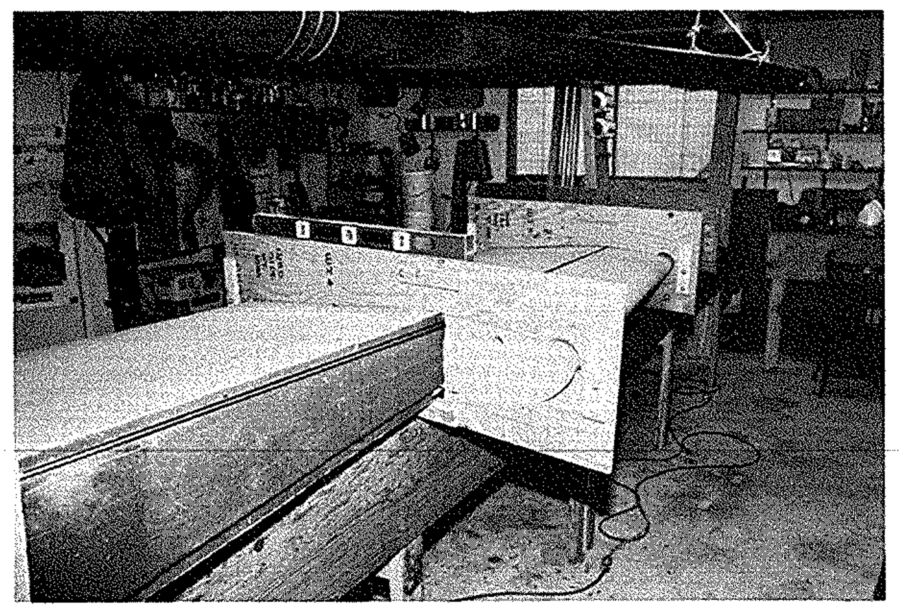
216. Right Wing. Wing tip at B.L. 100 - NOTE: Twist of spar stub.



217. Right Wing. Lay wing down and align jigs as shown to insure straight wing.

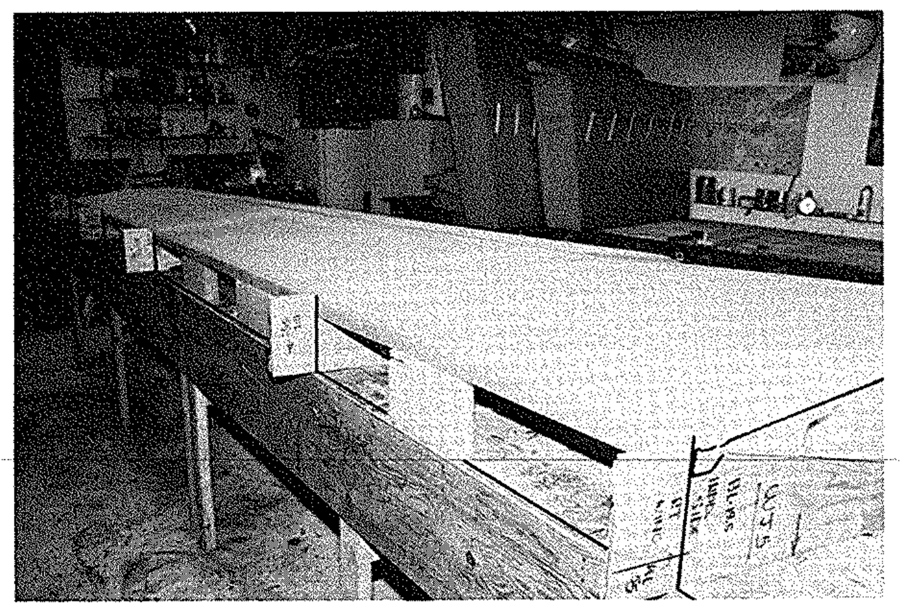


218. Right Wing. Bottom side up leveling and aligning. USE CARE.

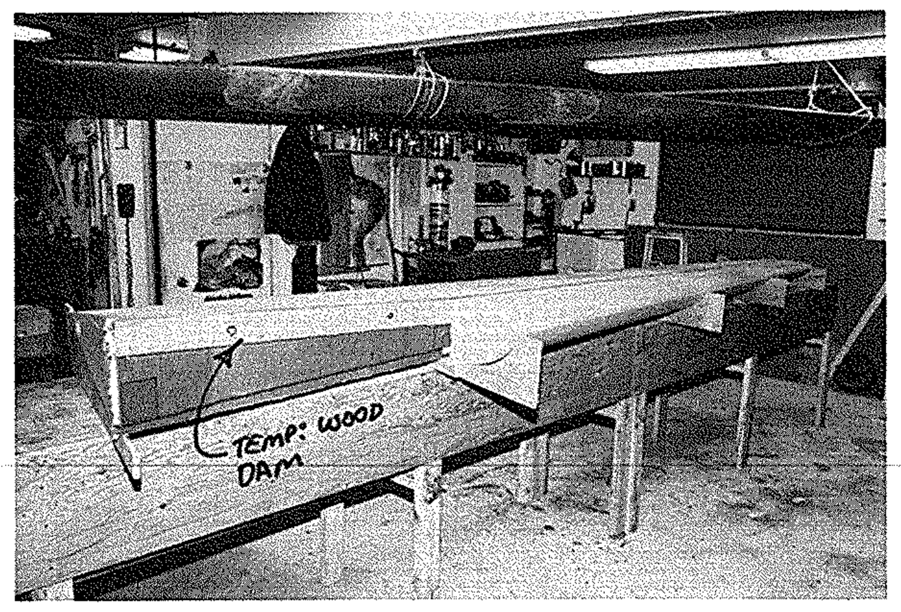


219. Right Wing. Show wing attach area before spar caps are placed.

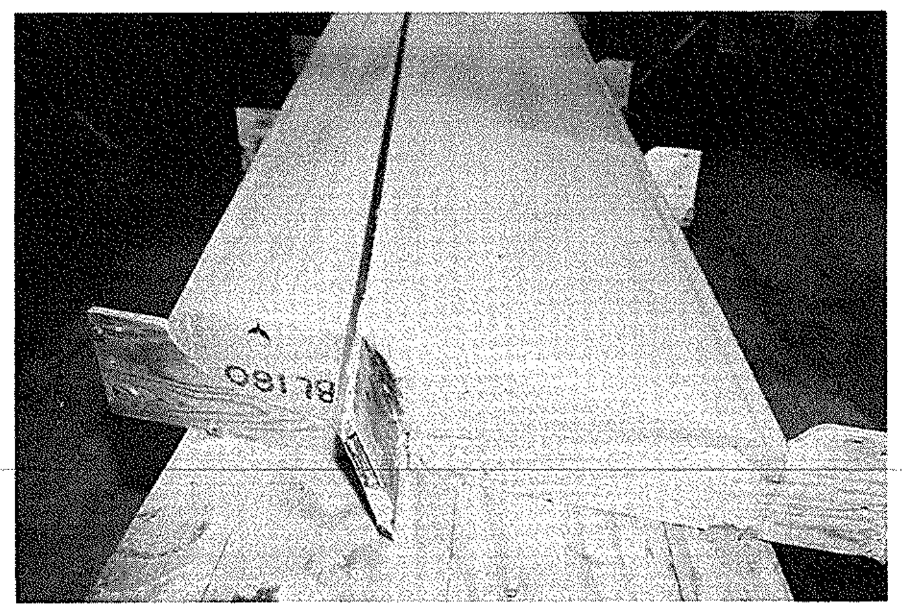
220. Right Wing. Wing tip at B.L. 180.



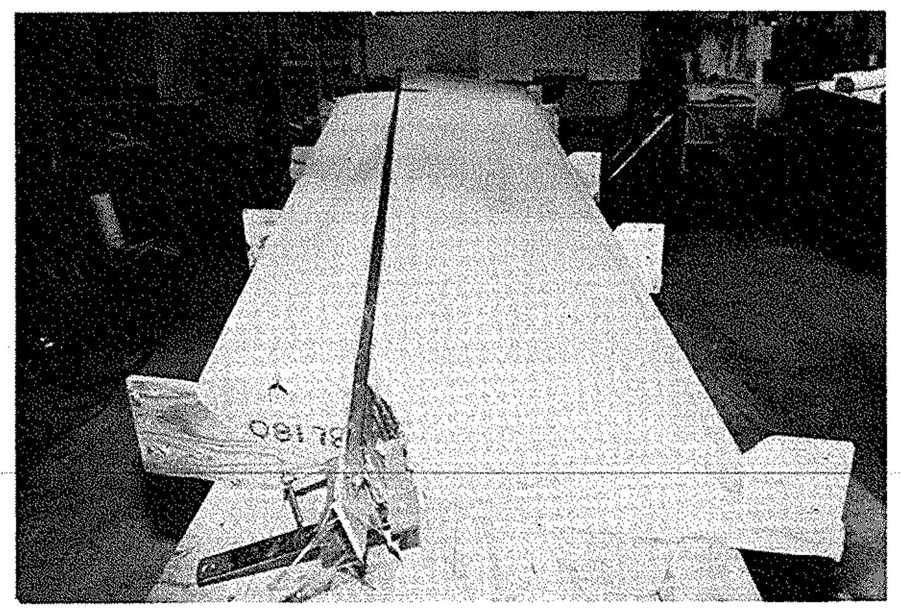
221. Right Wing. Remove jig half to ready for bottom spar cap.



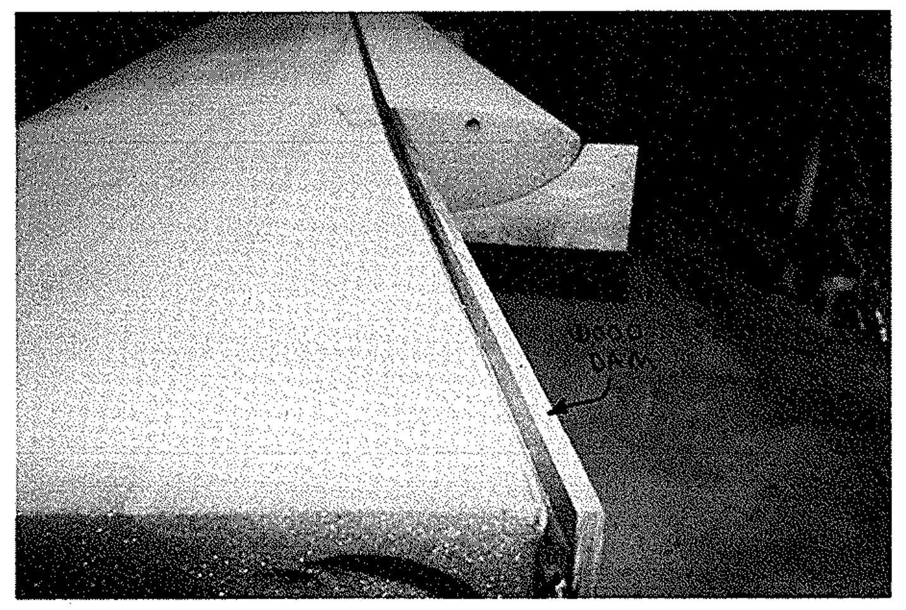
222. Right Wing. Place temporary plywood dam with grey tape facing spar cap.



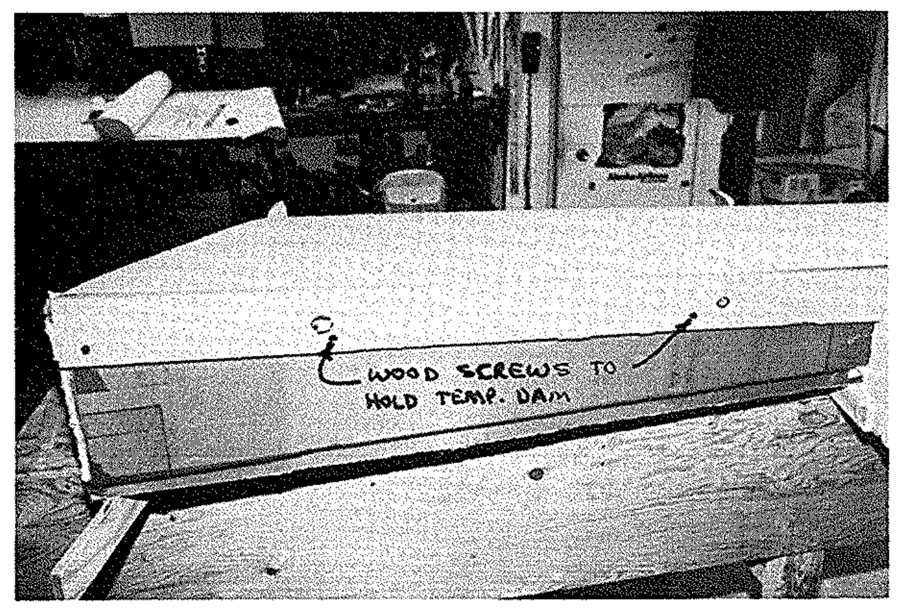
223. Right Wing. Remove temporary foam from spar troughs at stub. (SEE Section G-G D-31).



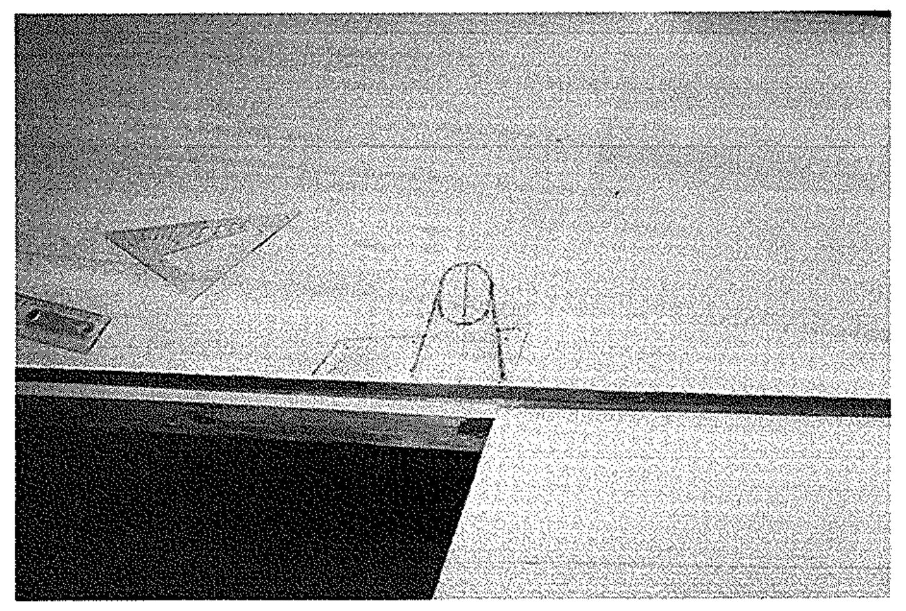
224. Right Wing. Clamp a temporary backing (piece of wood) to help stable edges of shear web layup ④.



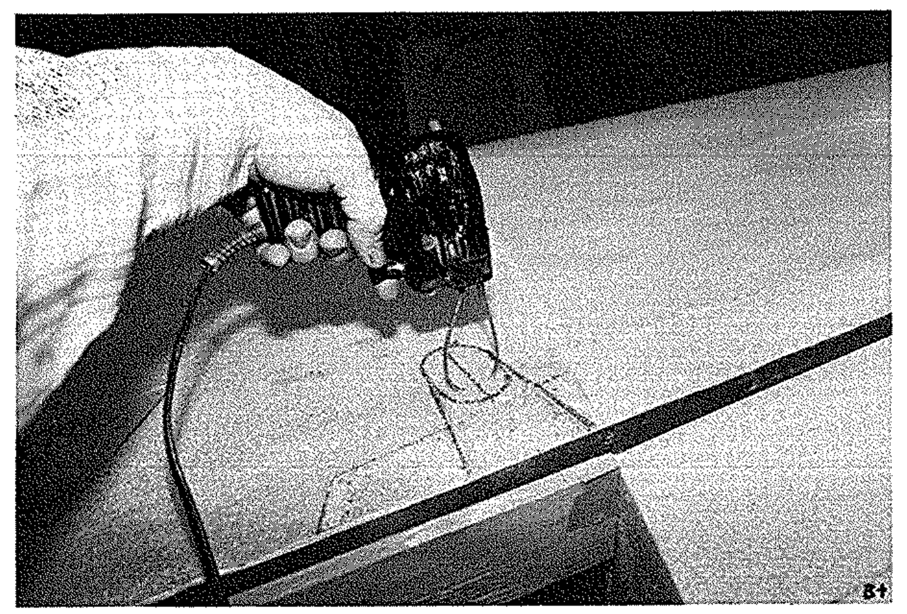
225. Right Wing. Temporary wood dam as also shown in Photo #222.



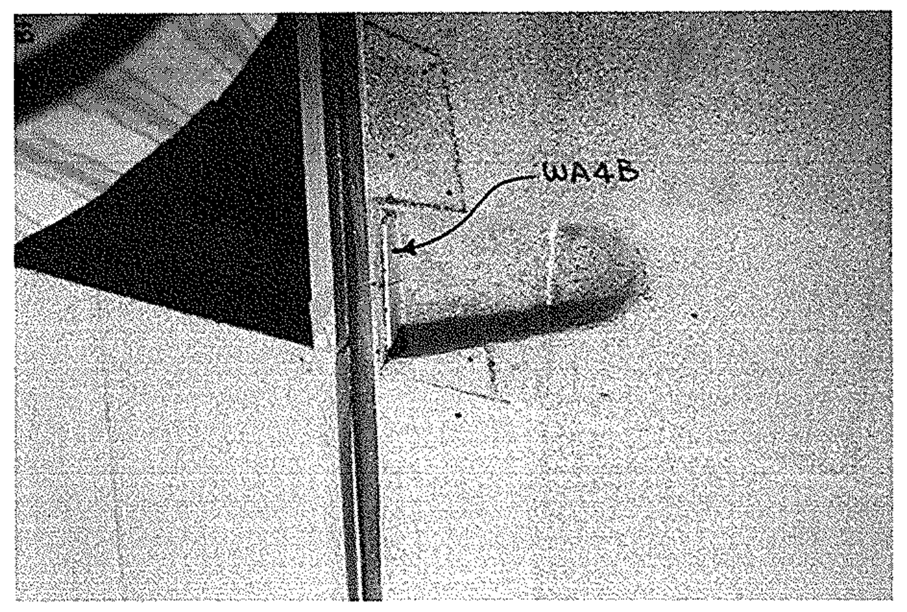
226. Right Wing. Wood dam continued.



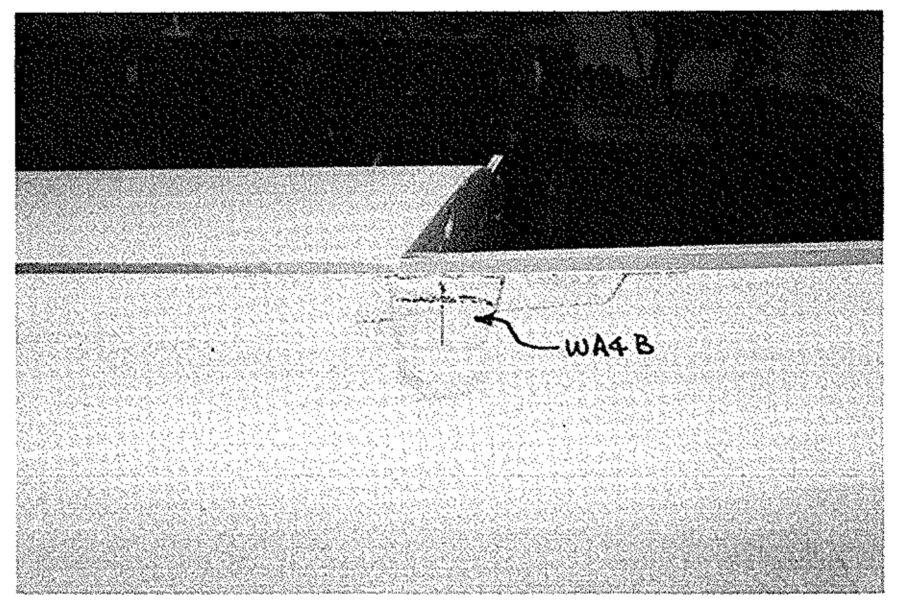
227. Right Wing. Layout outline of wing bolt access area. (SEE D-30 for detail).



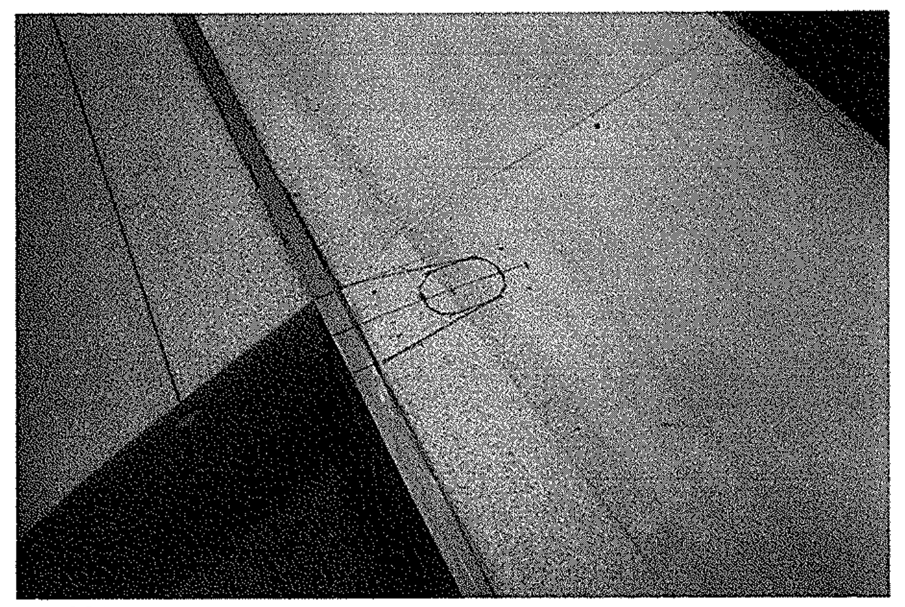
228. Right Wing. Carving away foam to form access to wing bolts.



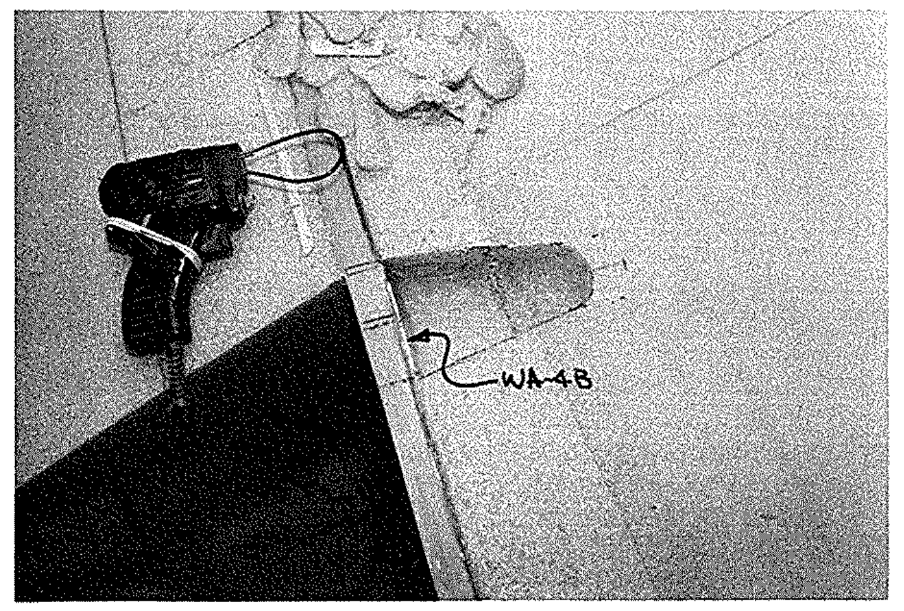
229. Right Wing. Access hole after carved to shape, exposing WA4B.



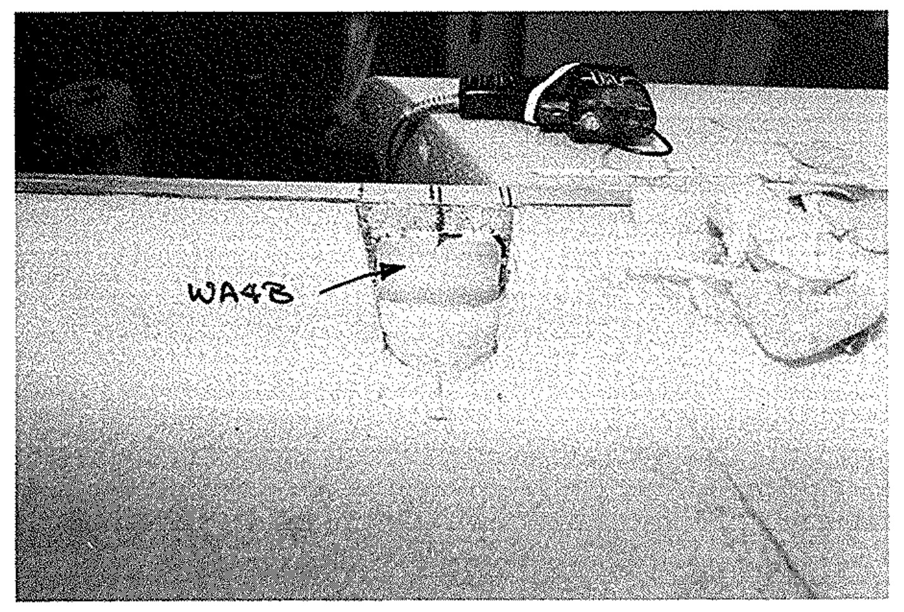
230. Right Wing. Different view of Photo #229.



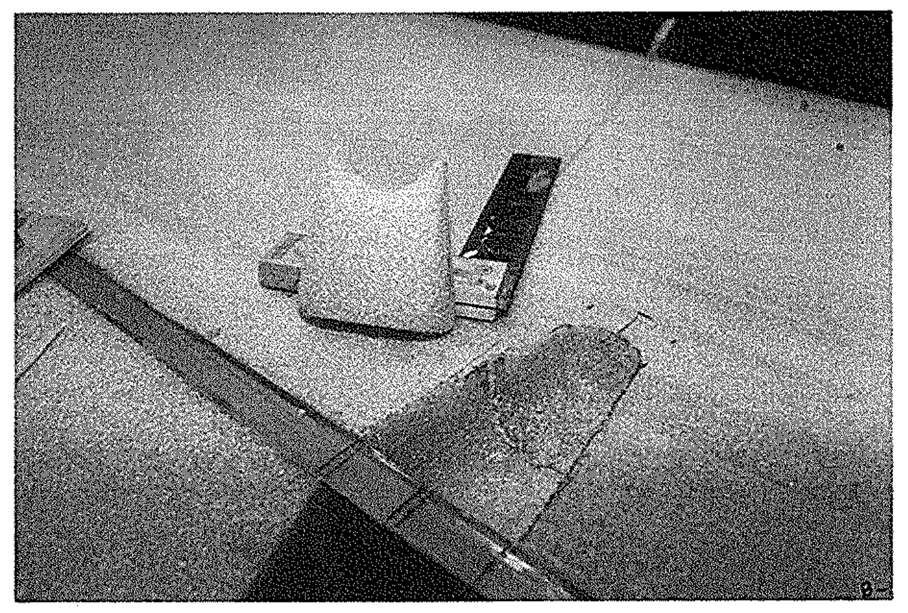
231. LEFT Wing. Laying out access outline on bottom side. Note spar cap has been placed in this photo.



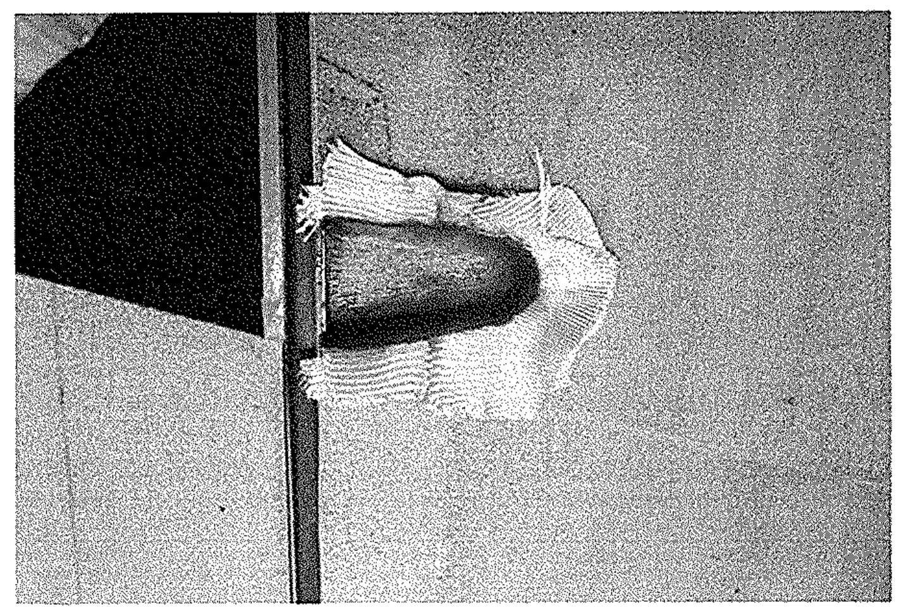
232. LEFT Wing. Access area is to shape with WA-4B exposed. This operation can be done before or after spar cap layup but has to be done before bottom wing skin layup.



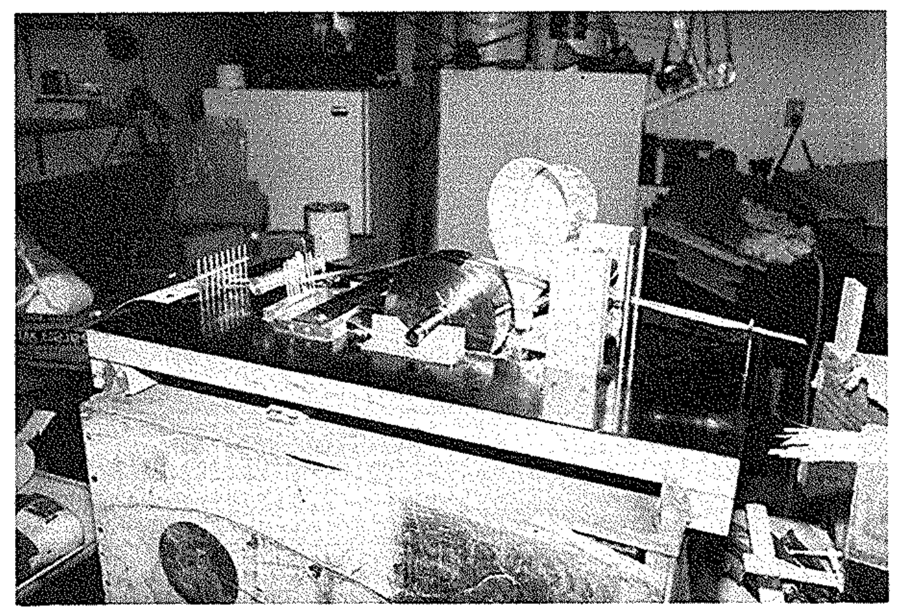
233. LEFT Wing. Access hole to wing bolt.



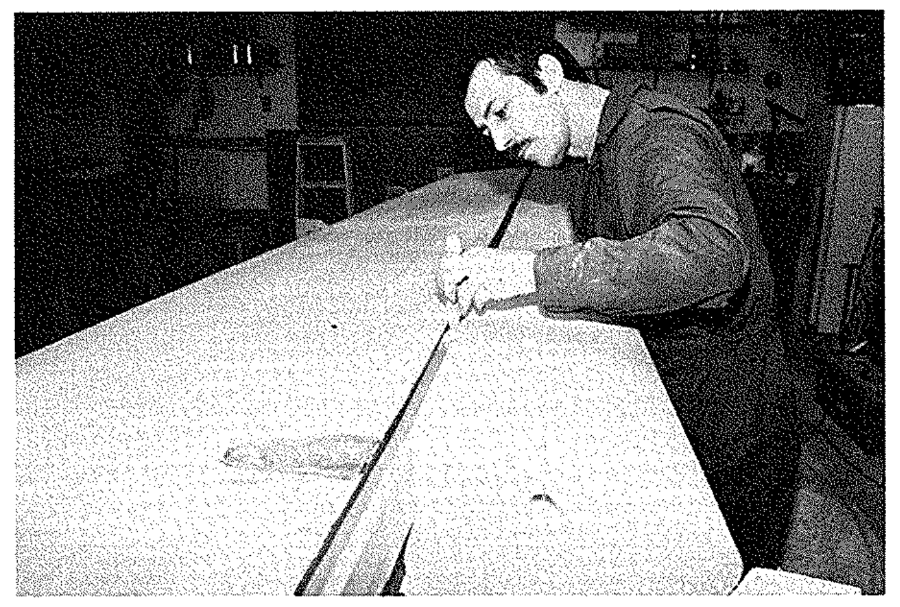
234. LEFT Wing. Shape foam part as shown and install into glass access area. (Study detail drawing D-30 - OUTBOARD WING ATTACH).



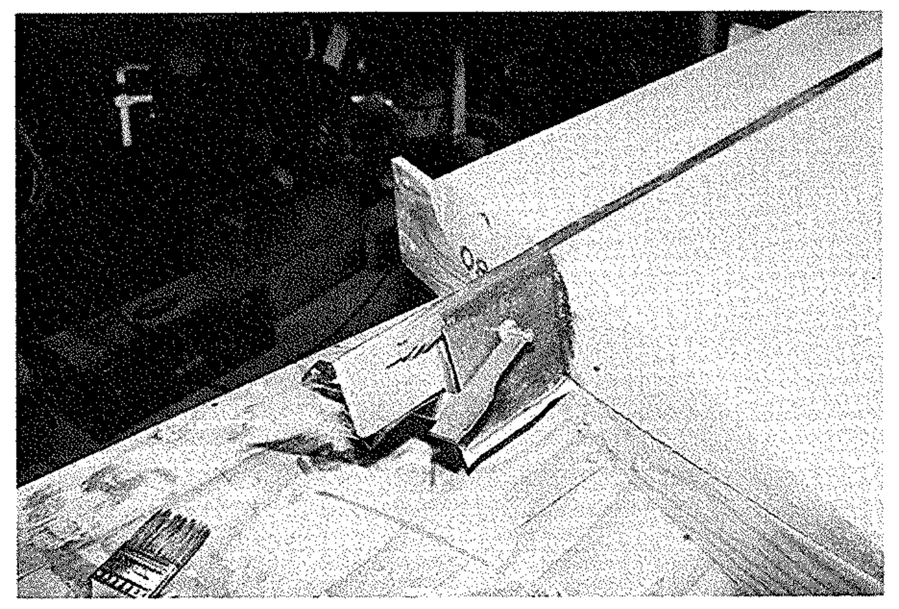
235. Right Wing. Layup ⑱ into access area. Foam part shown in Photo #234 is glassed 1 ply BID on curved side and placed in position as shown in Detail D-30.



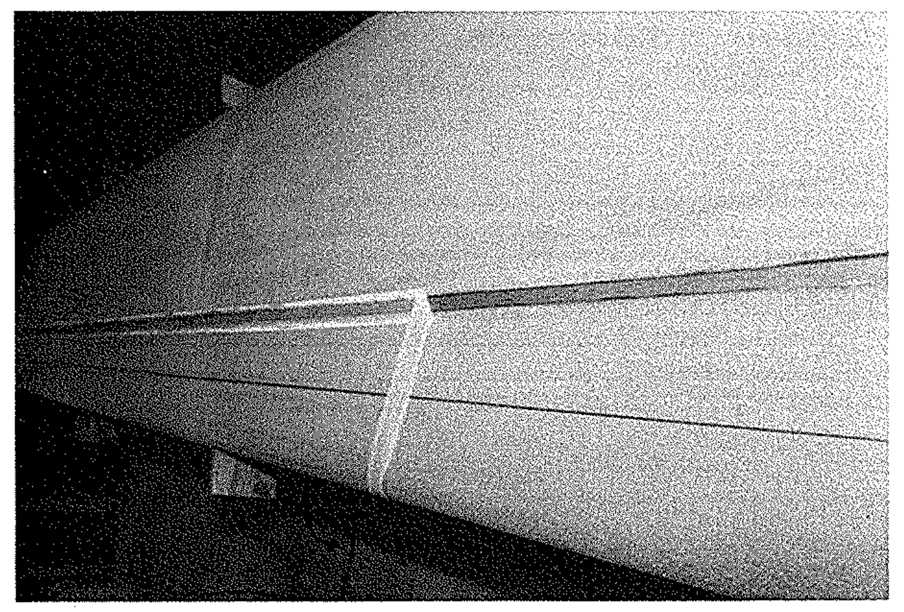
236. 'S' glass wet out machine. Note ends of 'S' glass extending from spar stub.



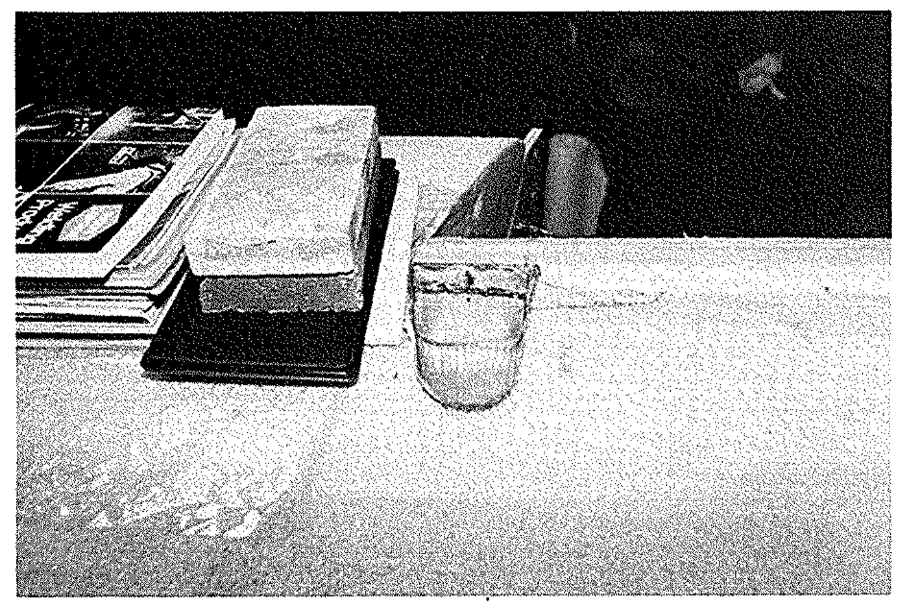
237. Right Wing. Doing bottom spar cap. Squeegee out every 80 to 100 strands. Work from center to each end when squeegeeing.



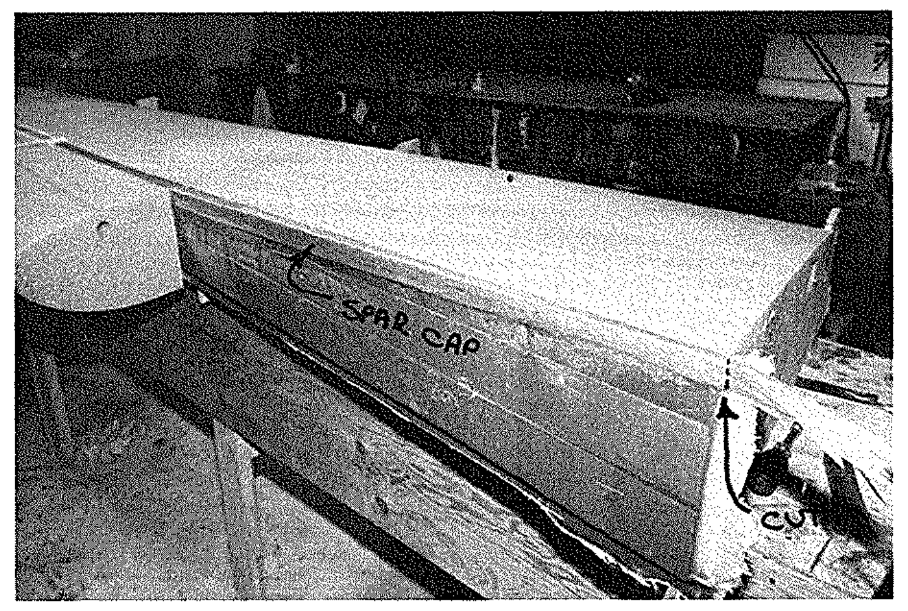
238. Right Wing. 'S' glass strand ends extending from spar stub.



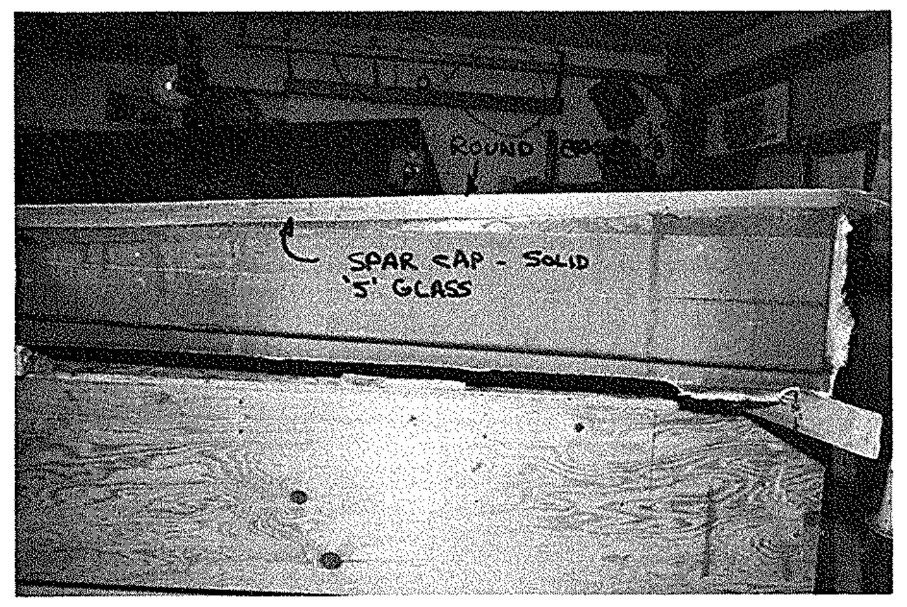
239. Right Wing. Peel ply and weight spar cap after placement.



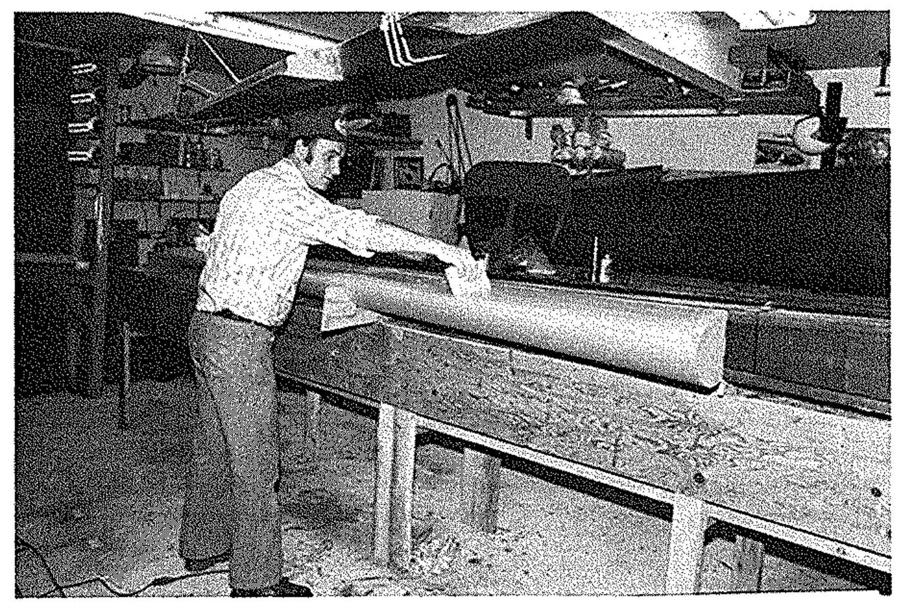
240. Right Wing. Weighting the spar cap.



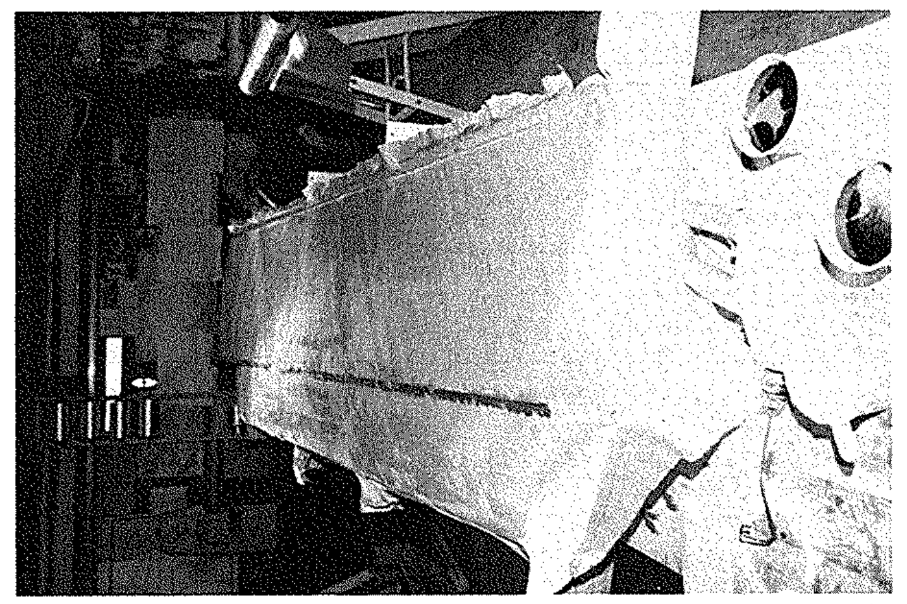
241. LEFT Wing. Bottom spar cap after temporary wood dam has been removed. Cut excess cap off with back saw.



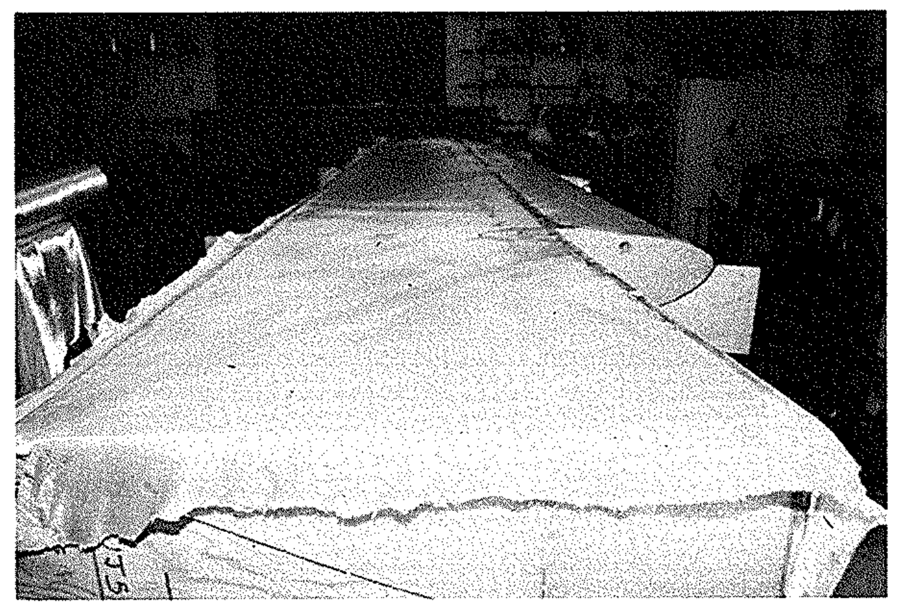
242. LEFT Wing. Bottom spar cap. Radius forward edge 1.8" before laying up bottom skin.



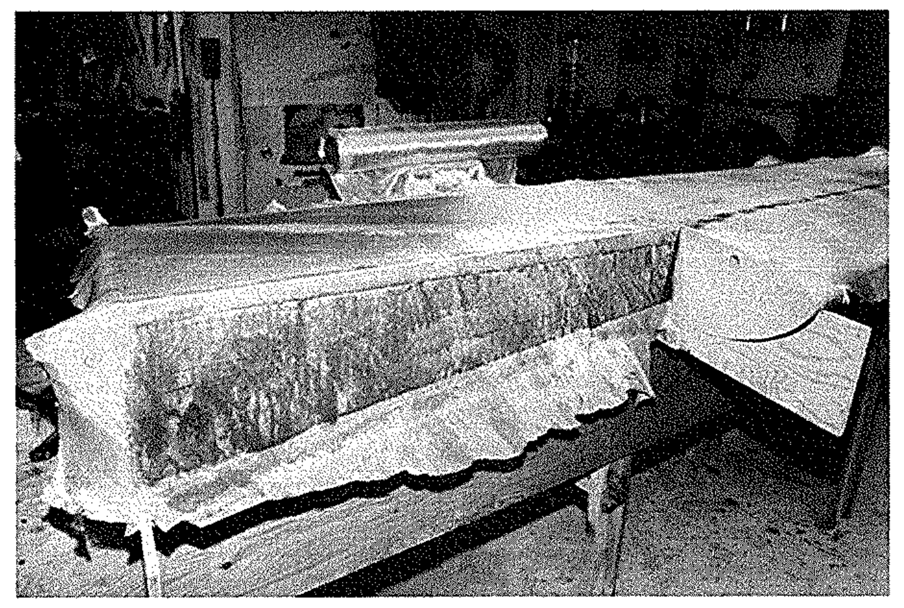
243. Left Wing. Slurry all foam surfaces (TYPICAL). Make sure you have done layup ⑱ . Place peel ply along aileron leading edge. (SEE D-31).



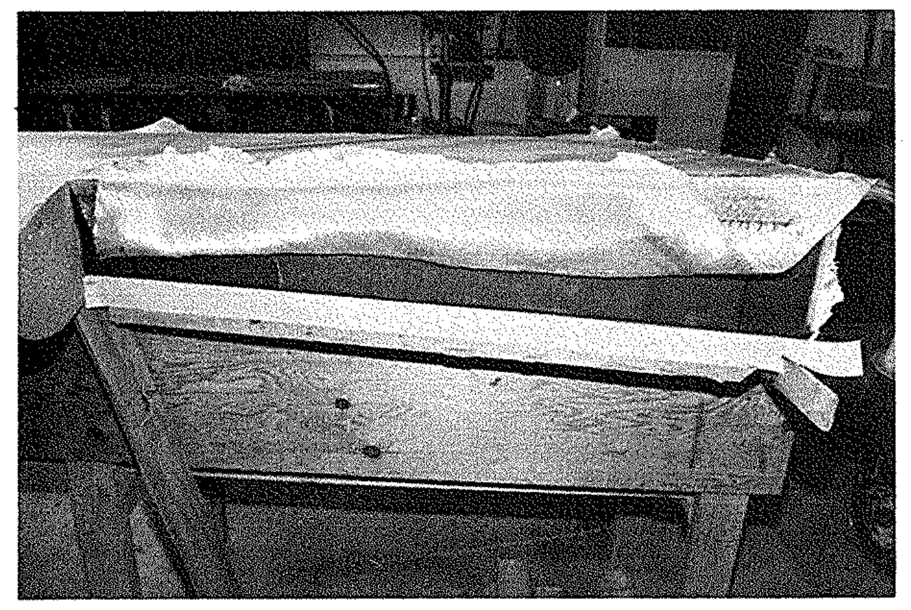
244. Right Wing. Paint spar cap with epoxy and begin bottom skin layup 6 . (SEE D-31) Check trailing edge for straightness, block if needed. (SEE Photo #250).



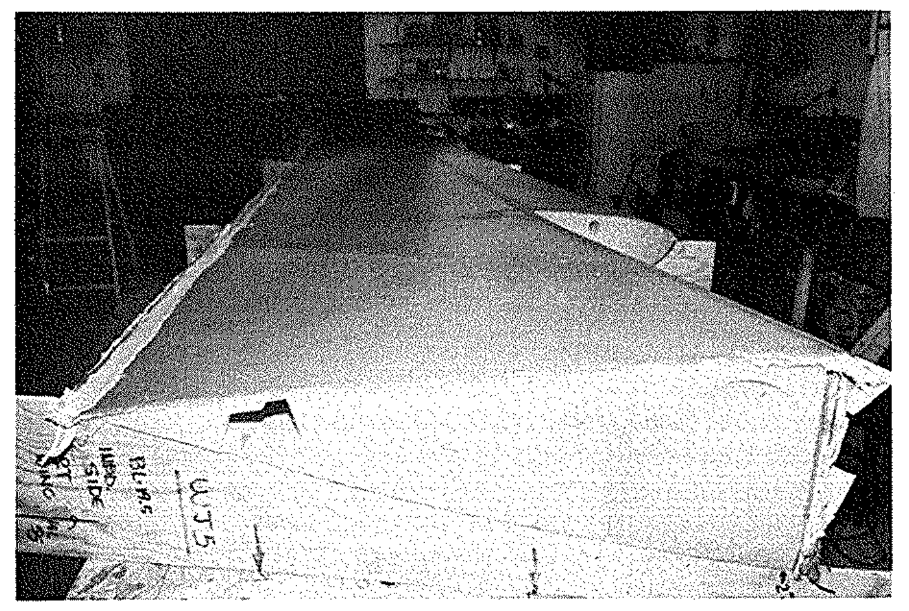
245. Right Wing. Glassing bottom skin - Layup 6 .



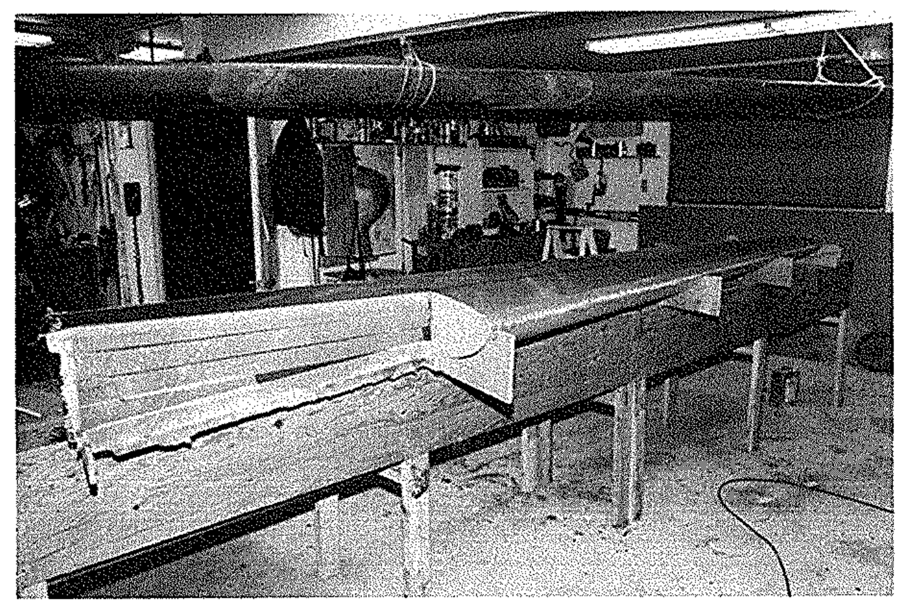
246. Right Wing. Lap full face of spar. NOTE: Install temporary wood dam with grey tape and peel ply as shown in Photo #247.



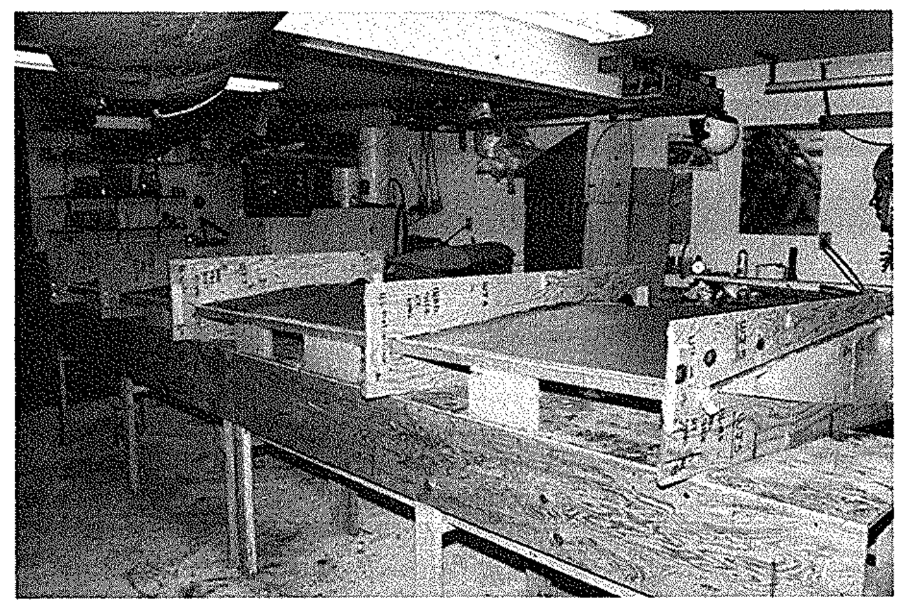
247. LEFT Wing. Place temporary plywood dam.



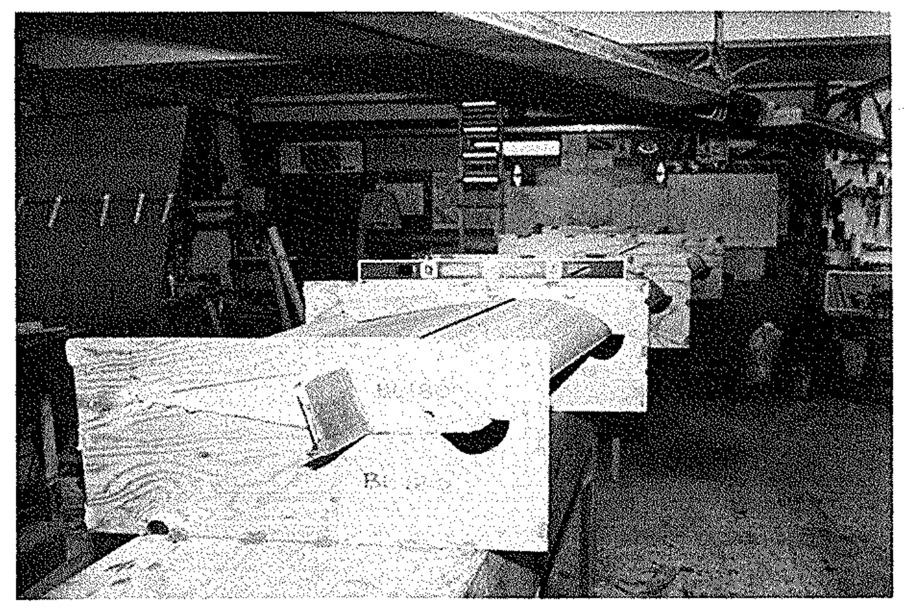
248. Right Wing. Complete layup ⑥, bottom skin.



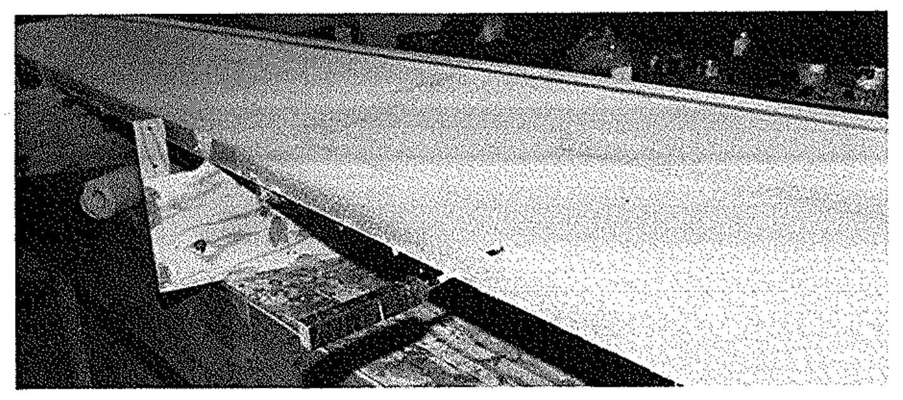
249. Right Wing. Peel ply face of spar as shown.



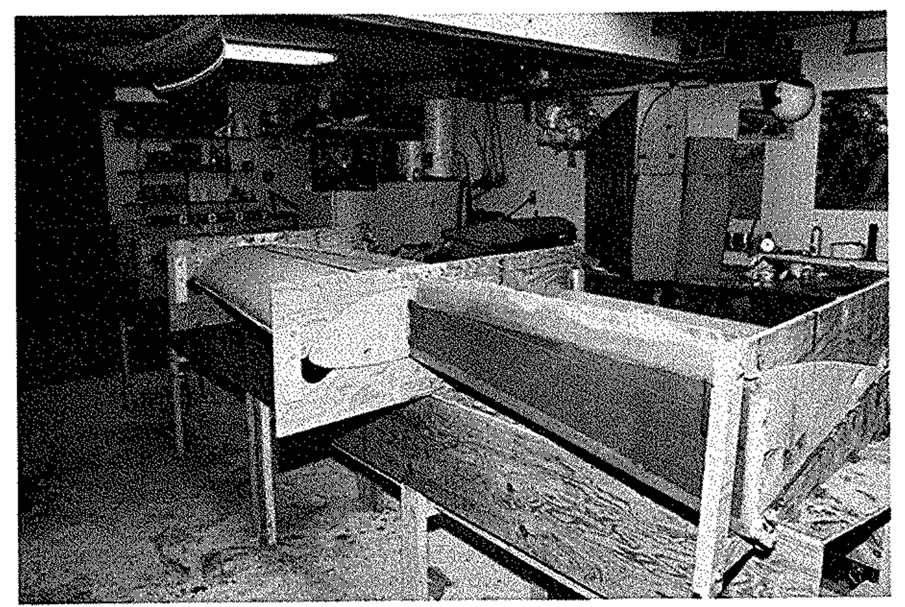
250. Right Wing. Make sure trailing edge is straight. Use foam blocks to correct if necessary. After cure reattach jigs with bondo and turn wing over.

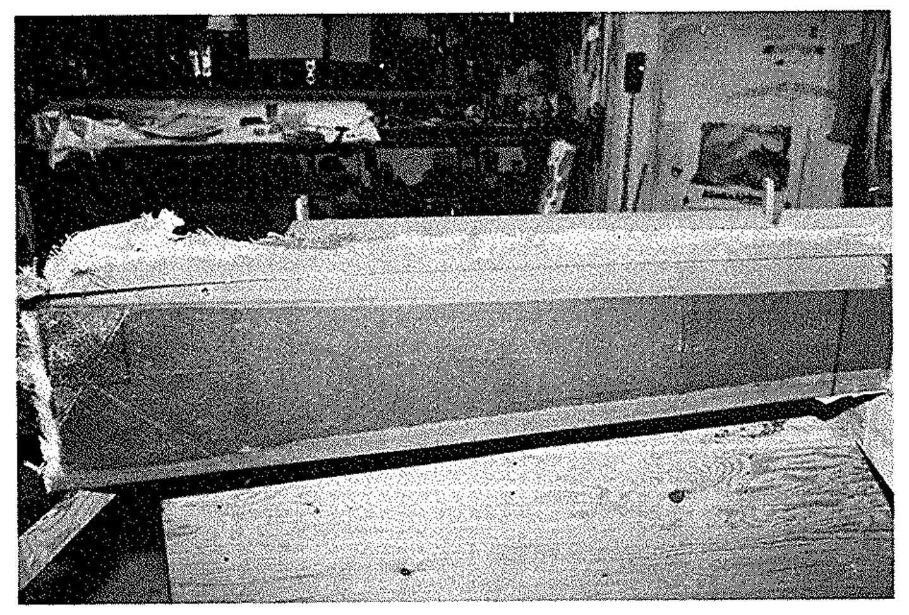


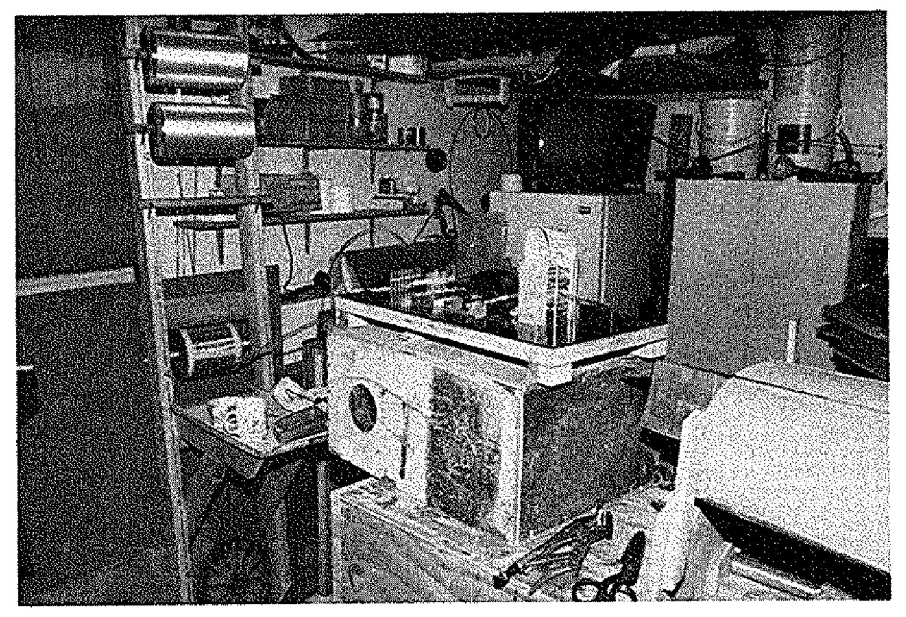
251. Right Wing. After turning wing over, check level and bondo jig to table.

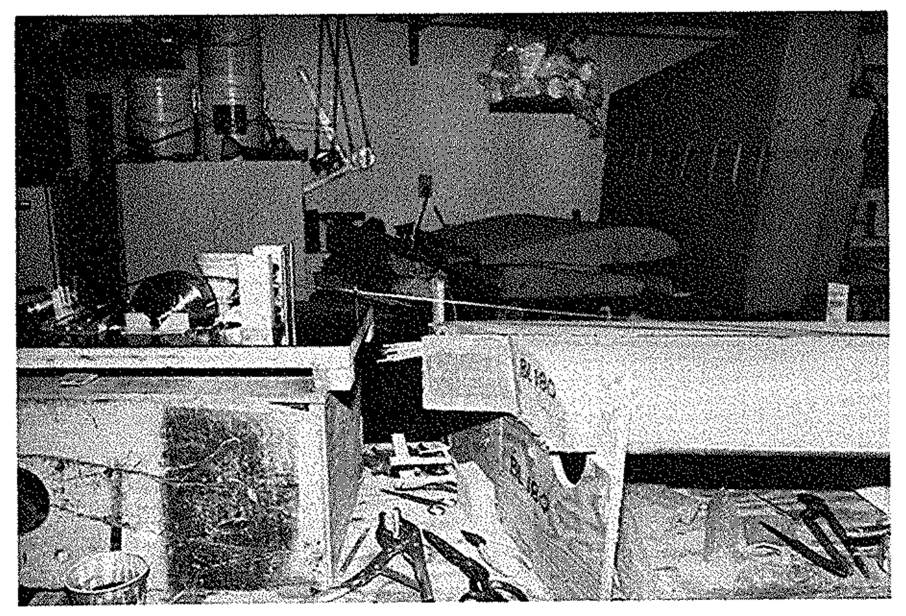


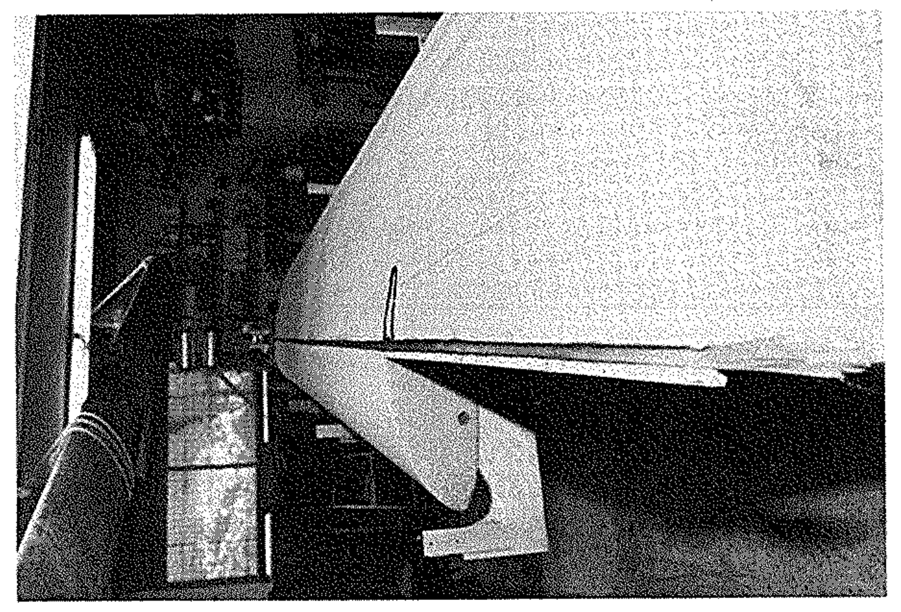
252. Right Wing. Remove foam from trailing edge. Make sure trailing edge is straight before doing top skin.

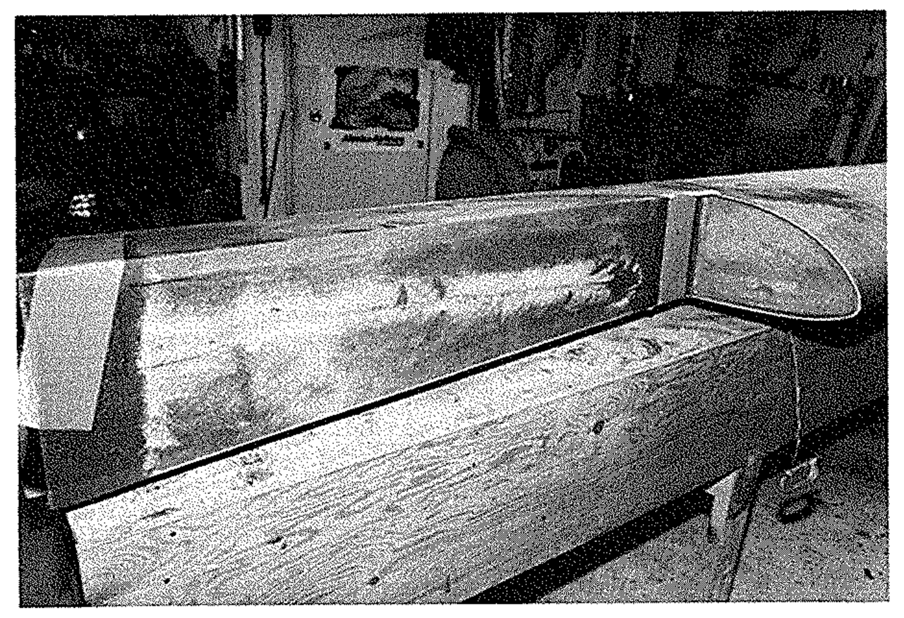

253. Right Wing. Remove jig halves, trim bottom skin at spar cap and carve wing attach access area as shown in Photo #226 through #235.

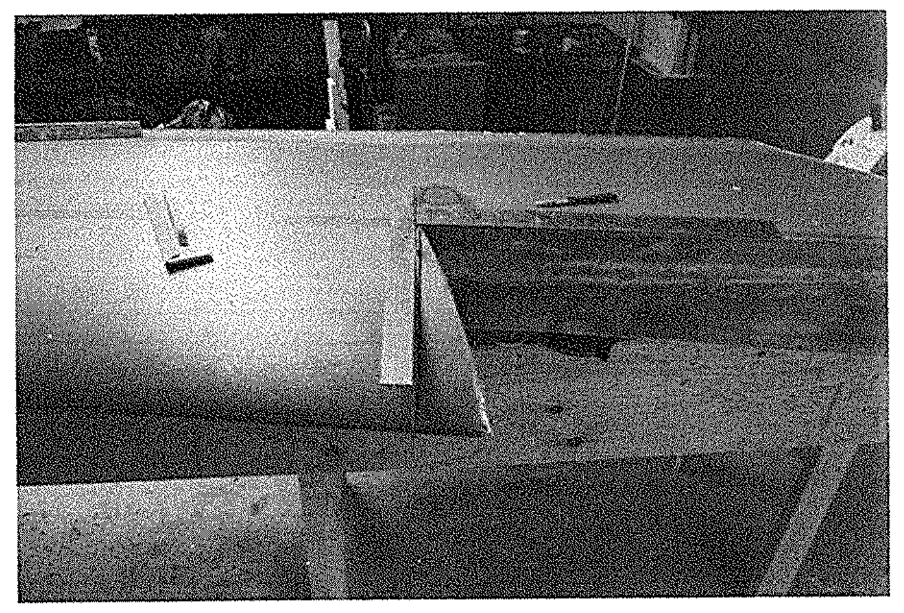

254. LEFT Wing. Trim bottom skin along top of spar trough.

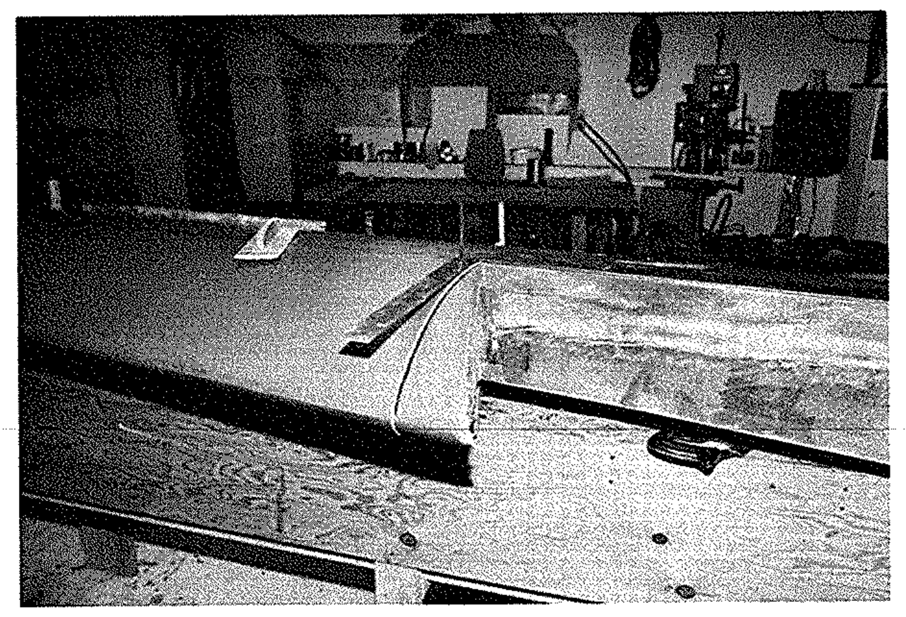

255. Right Wing. Set up 'S' glass wet out machine and begin top spar cap. Repeat same procedures as on bottom spar cap.

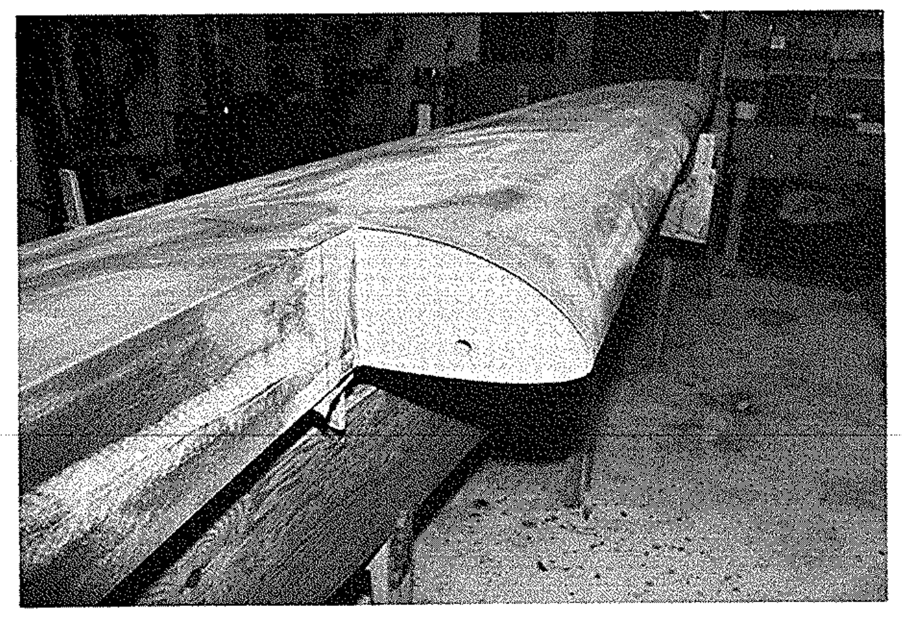

256. Right Wing. 'S" glass strand going into top spar trough.

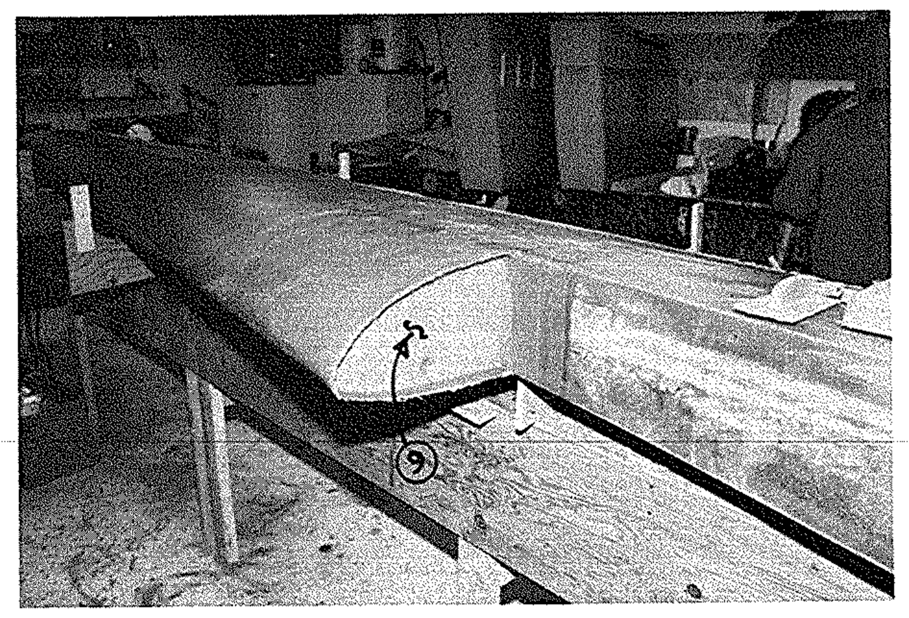

257. Right Wing. Top spar cap, installing 'S' glass strands, fill trough, peel ply and weight spar.


258. LEFT Wing. Do layup 8 as shown on D-31.

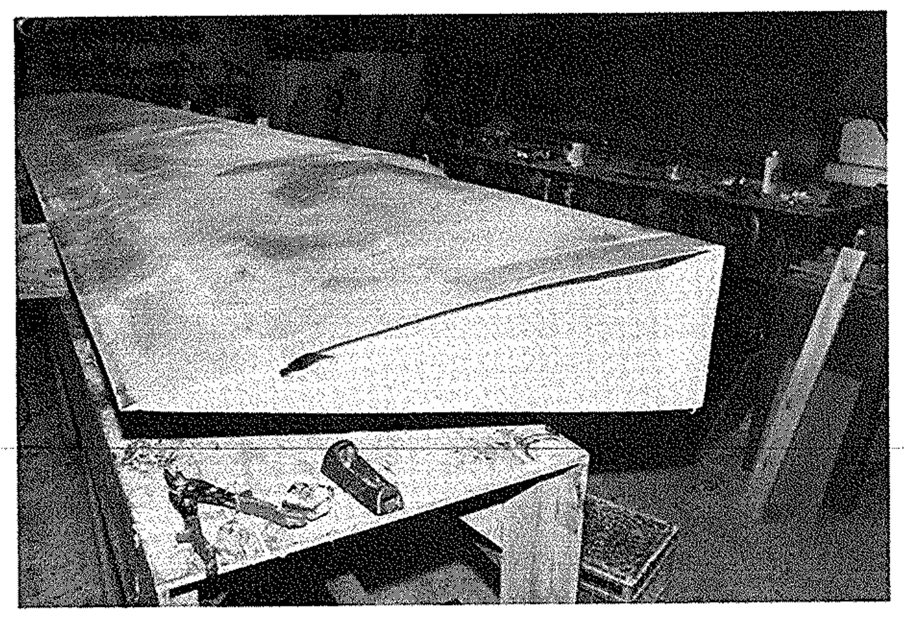

259. Right Wing. Cut leading edge at B.L. 59.35 to 90° angle to face of inboard wing spar surface. (SEE D-32).

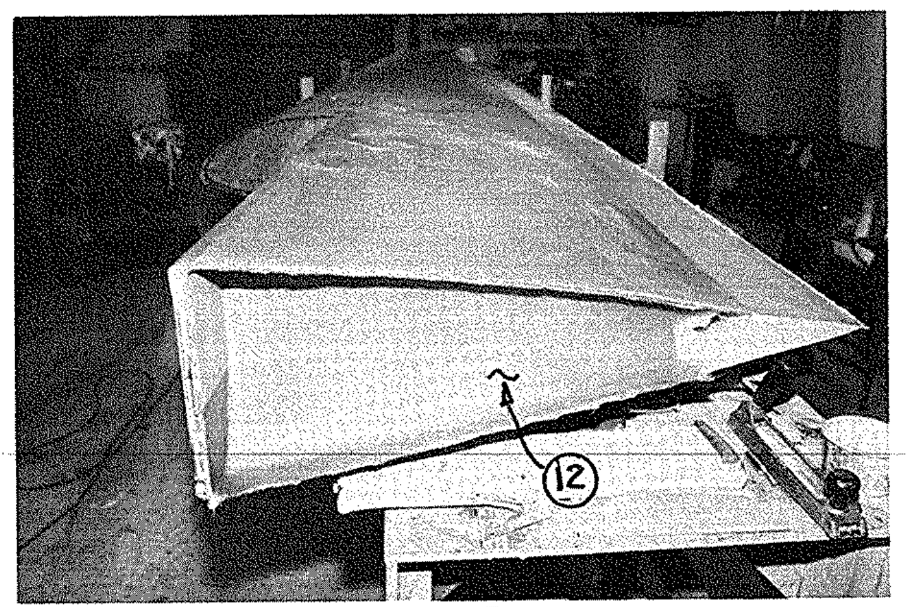

260. Right Wing. Different view, make 90° leading edge cut.


261. LEFT Wing. Remove .7" of foam in end rib and do layup #9.

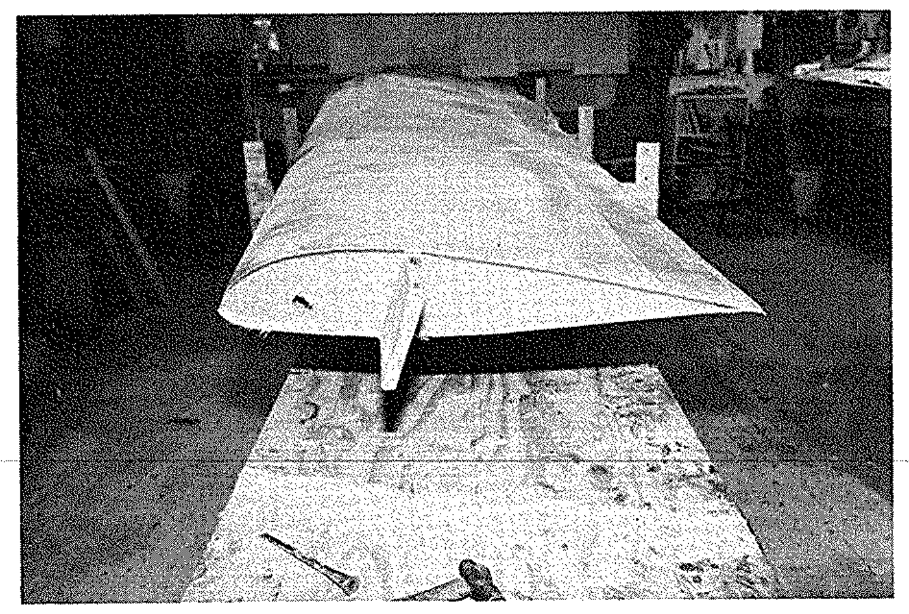


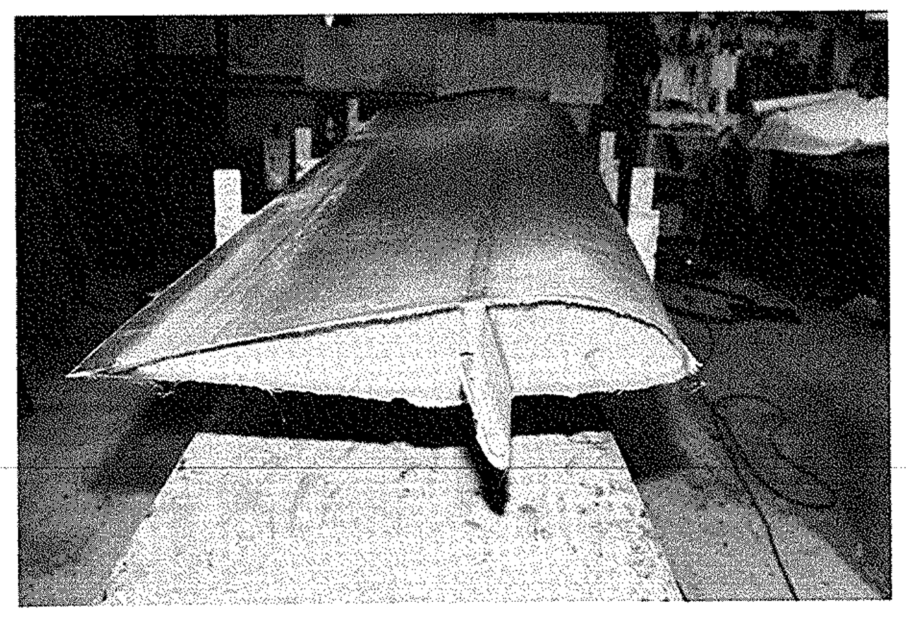
262. Right Wing. Shows layup ⑨.

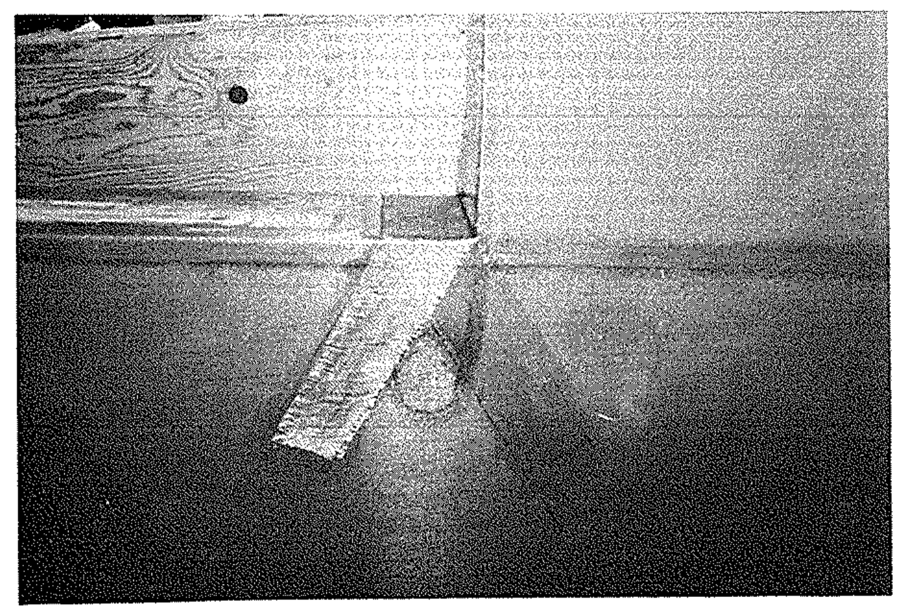

263. LEFT Wing. Remove foam from root end of wing B.L.19.5 and do layup 12 . (SEE D-32).

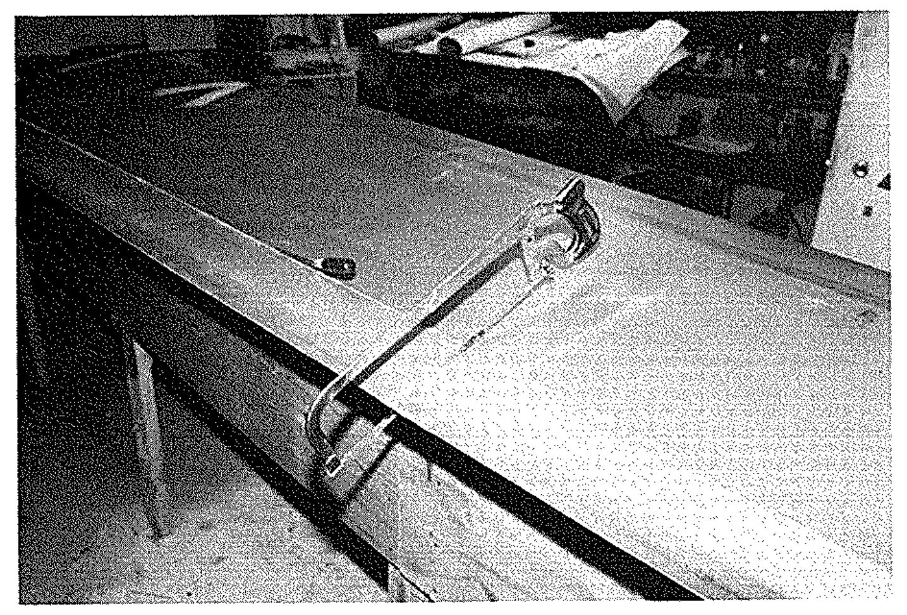


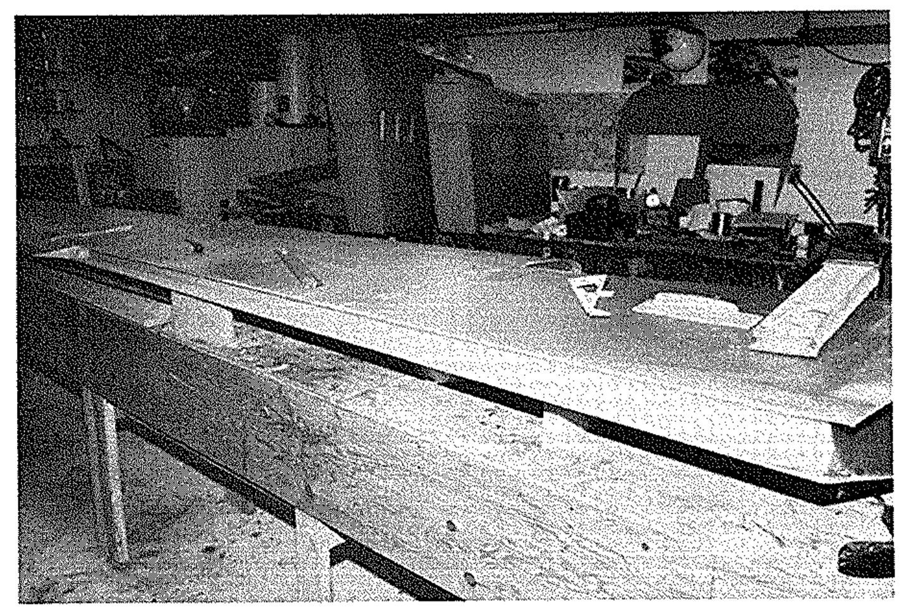
264. Right Wing. Layup ⑫.

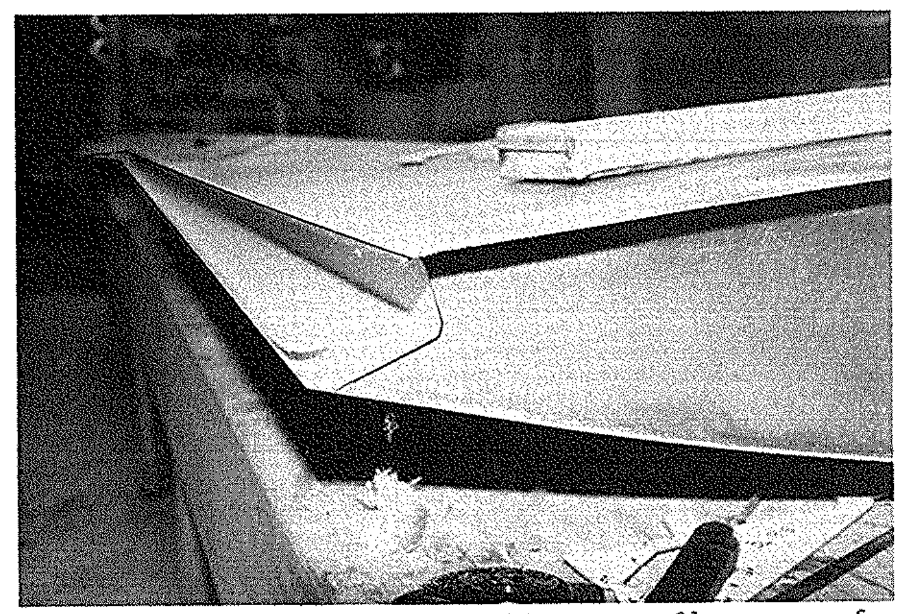

265. LEFT Wing. B.L.180. Remove .7" of foam for end rib. (SEE D-21) Winglet drawing for layup ④

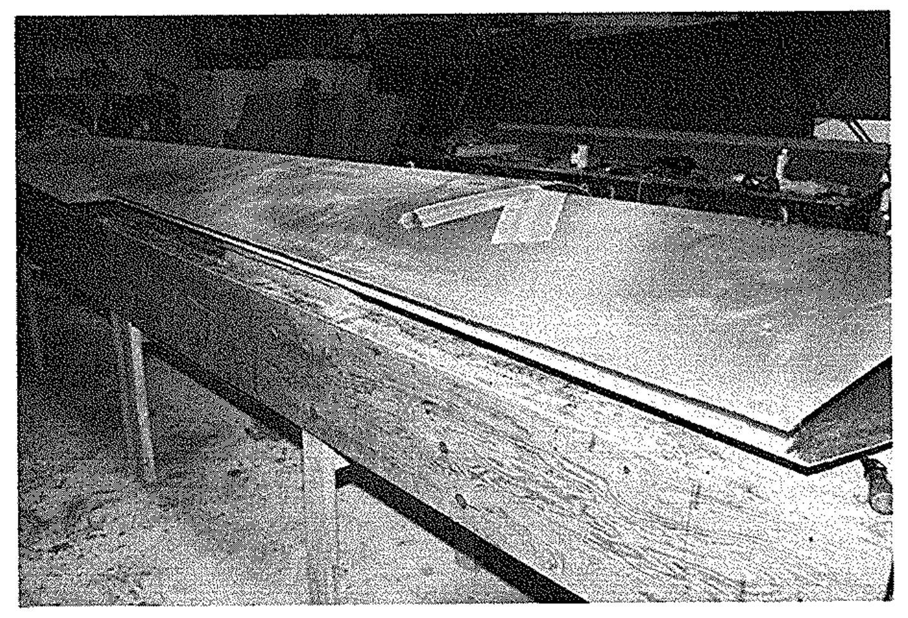

266. Right Wing. B.L.180. Layup ④ as shown on D-21.

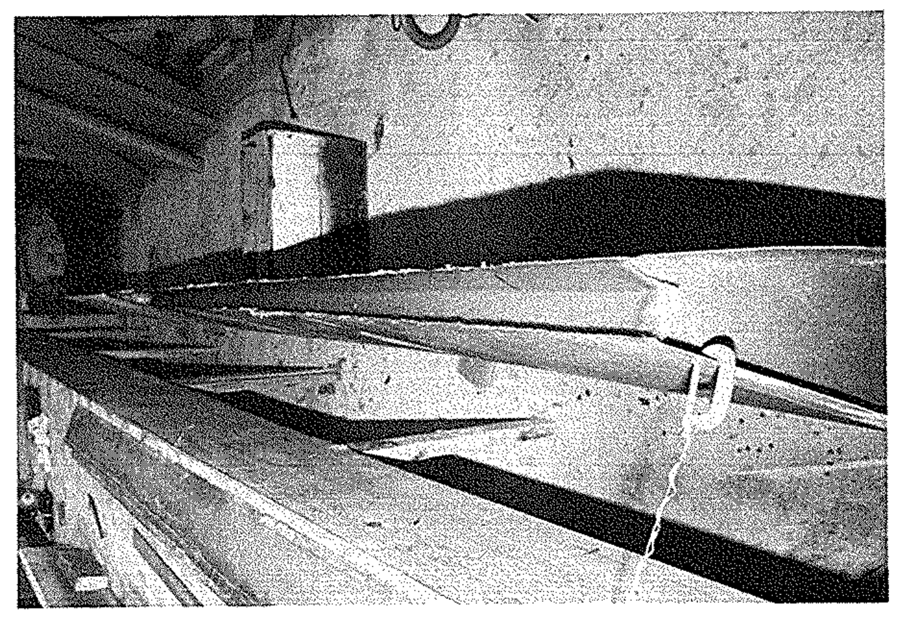

267. Right Wing. Do layups ⑩ and ⑪ . These layups are the same on the bottom of wing as shown on top of wing.

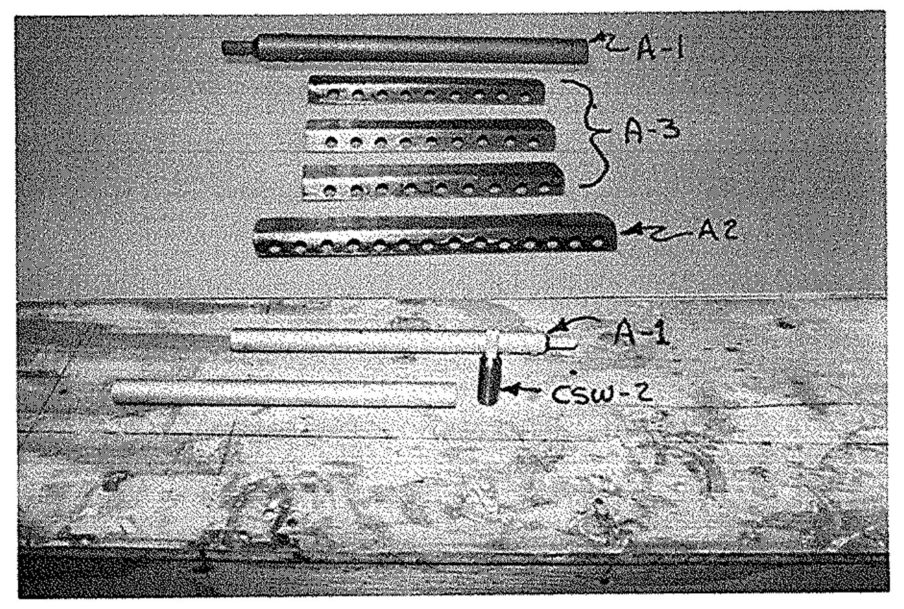

268. Right Wing. Cut out ailerons as detailed on D-32.


269. Right Wing. Bottom side up - shows wing after removing aileron.

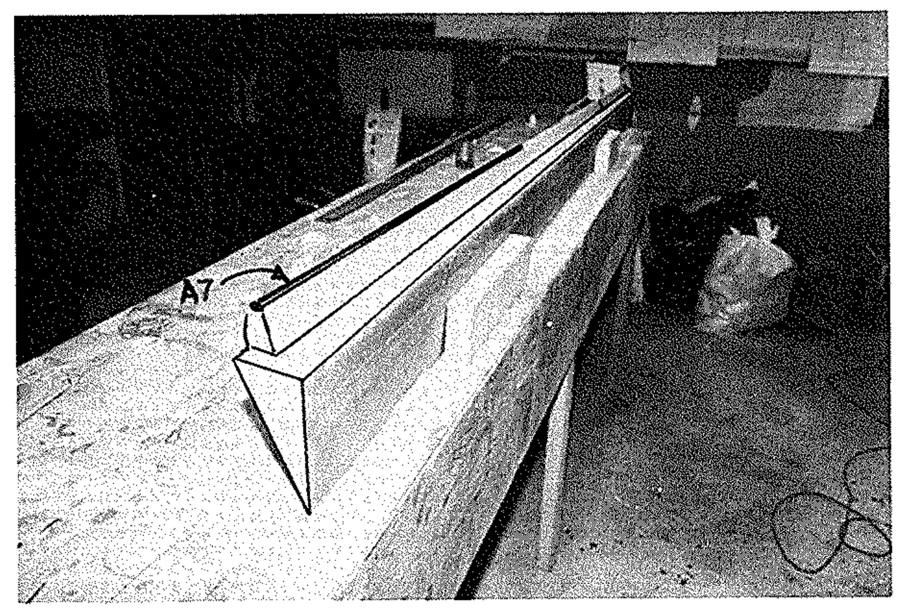

270. Right Wing. Bottom side up. Close up of aileron cut. Remove peel ply and foam along trailing edge of both top and bottom skins.


271. LEFT Wing. Right side up. Note peel ply on layup ⑩.

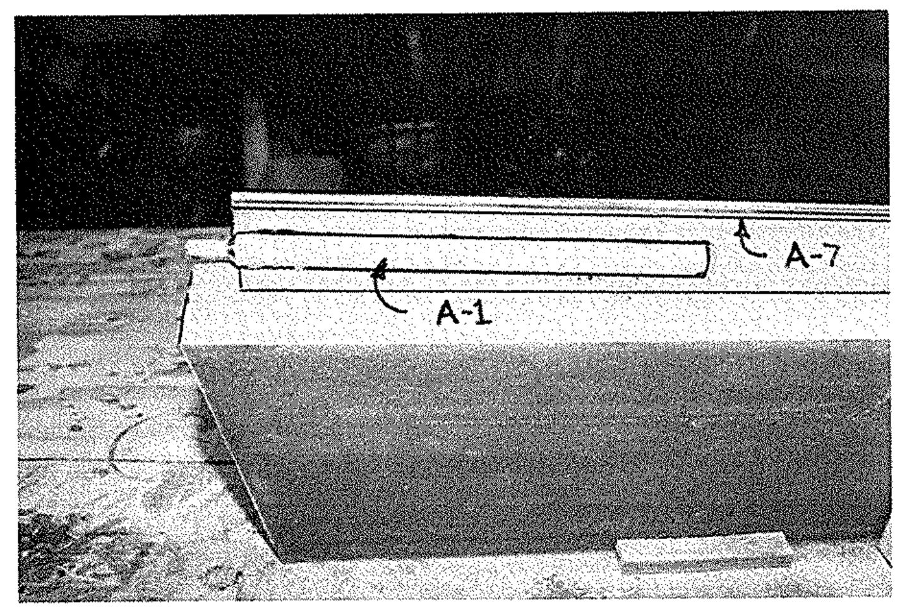

272. LEFT Wing. Do layup ⑬.



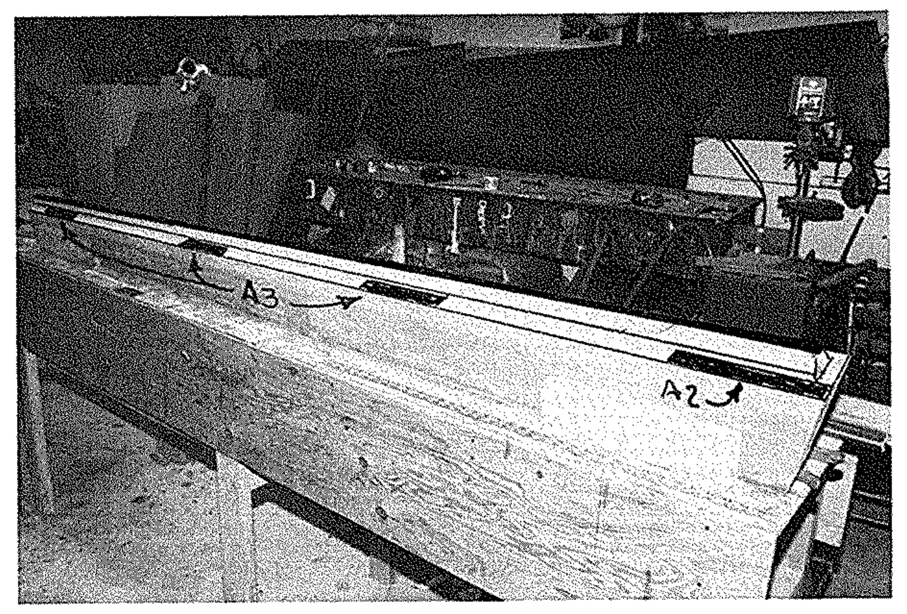
273. Aileron hardware.



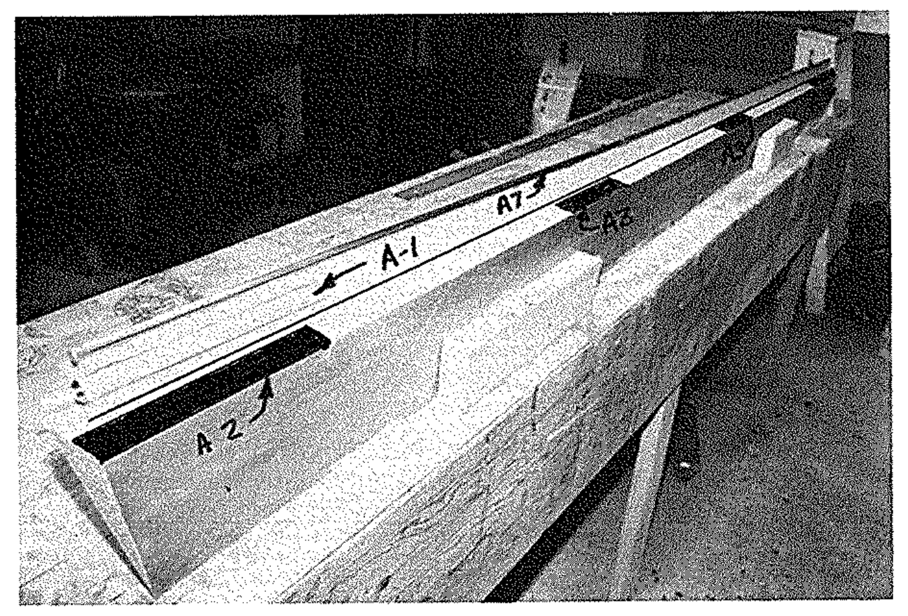
274. Right Aileron. Placing A-7 (3/8" steel rod counter balance).



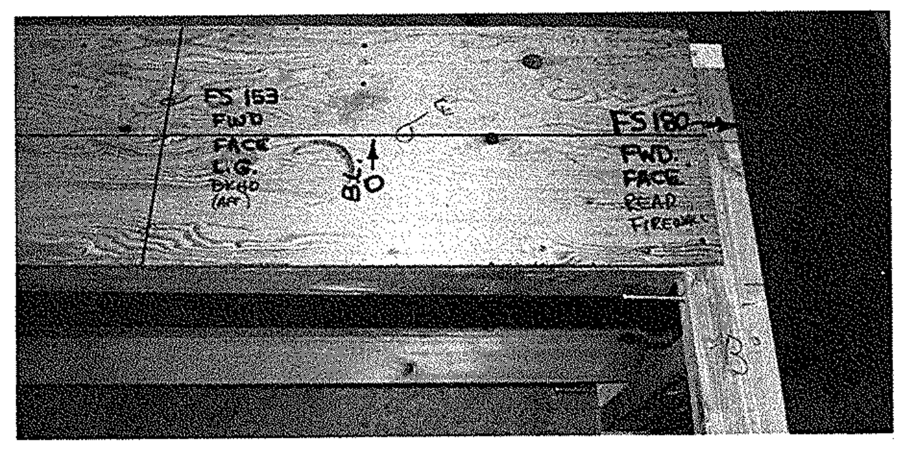
275. Right Aileron. Position of A-1 and A-7.



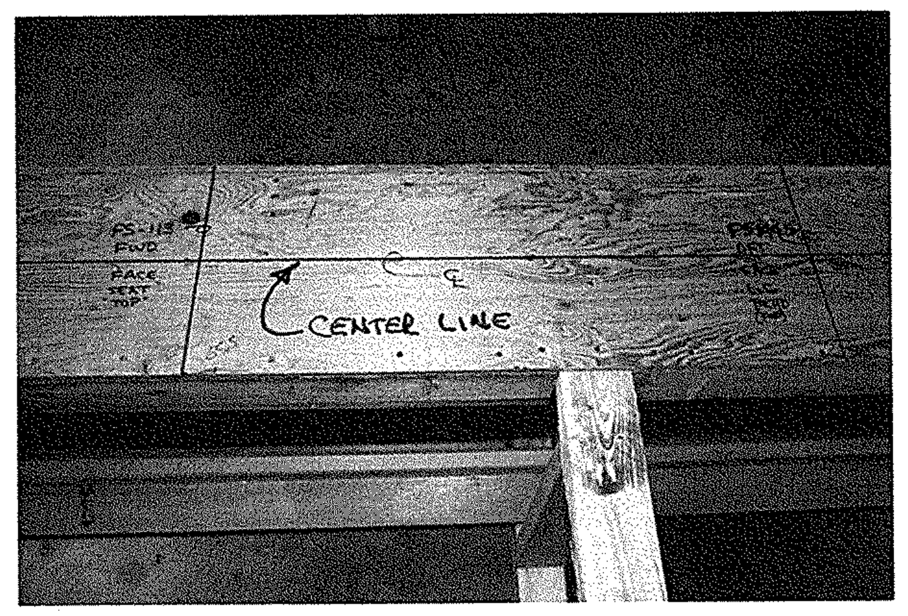
276. LEFT Aileron. Install A2 and A3s as shown on Detail D-32.



277. Right Aileron. After placement of parts shown. Do layups ⑮, (15A), ⑯ and ⑰.



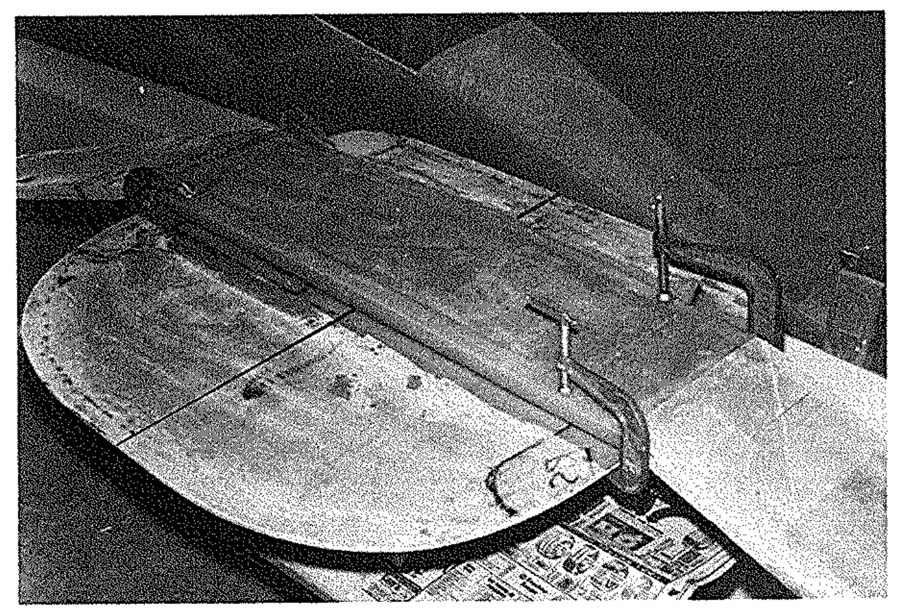
278. Fuselage layout. See D-33 for setting up bulkheads. Use 8 feet and 4 feet table sections for stiff back to build fuselage. Bondo table to floor. Very carefully mark off fuselage stations as shown.

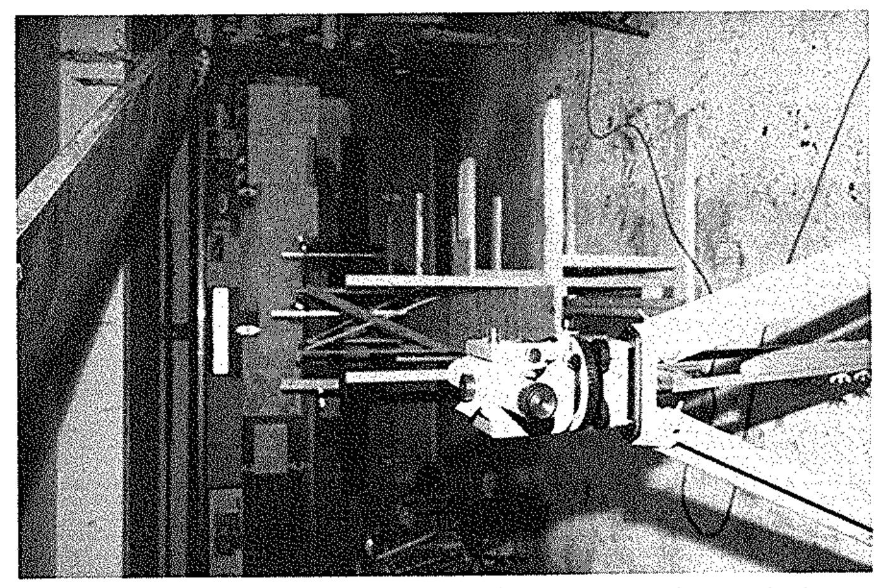


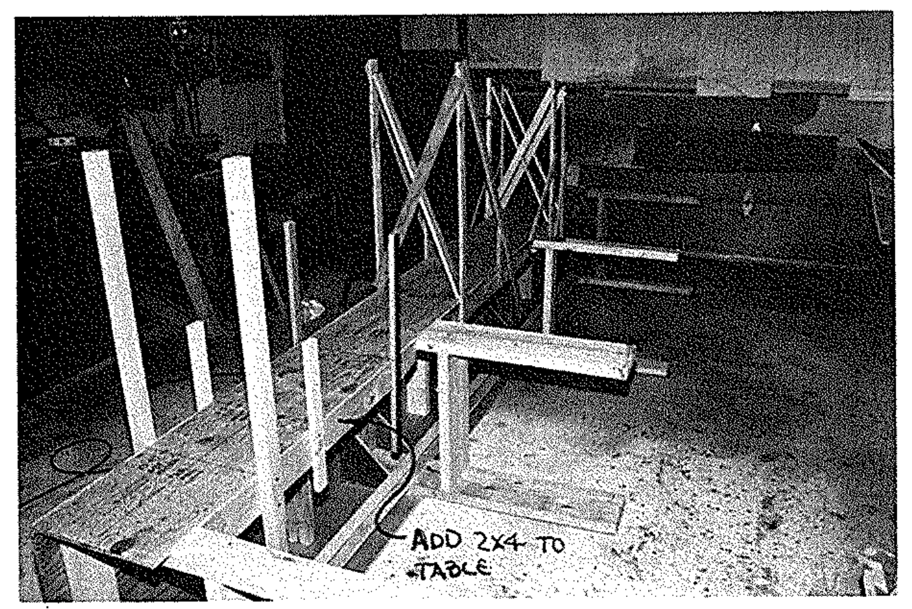
279. Fuselage Layout. Continue of fuselage stations.

280. Fuselage Layout. Continue of fuselage stations.

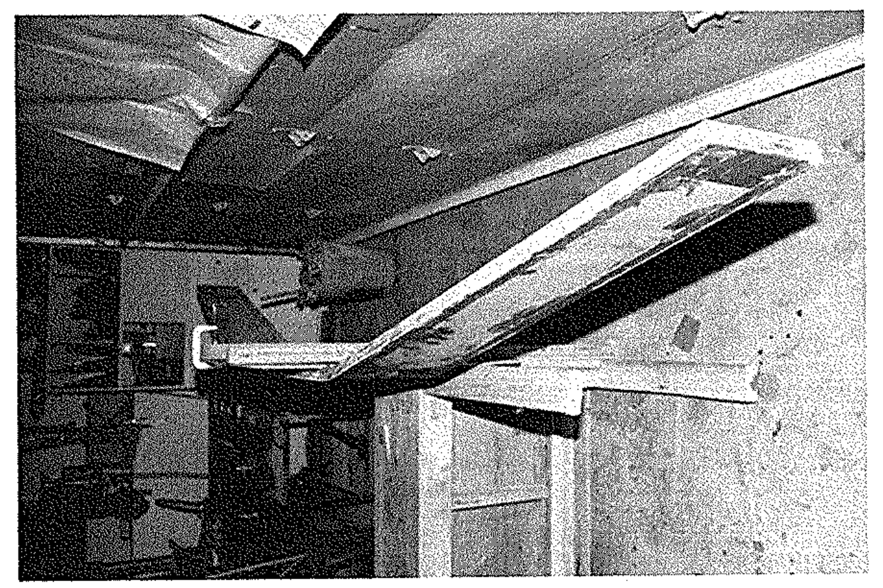
281. Fuselage Layout. Continue of fuselage stations.

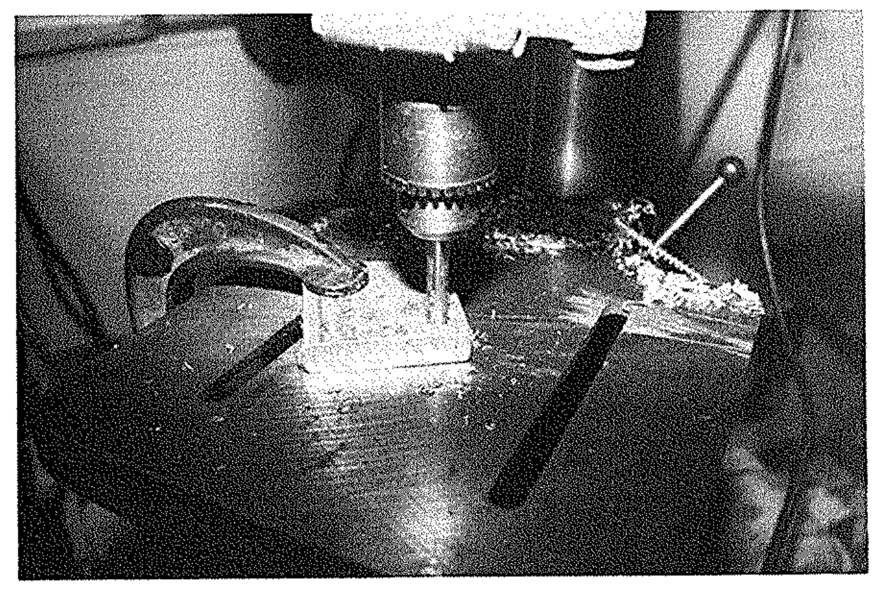

282. Wet flox main carry through spar (Centersection spar) to forward face of aft firewall bulkhead.

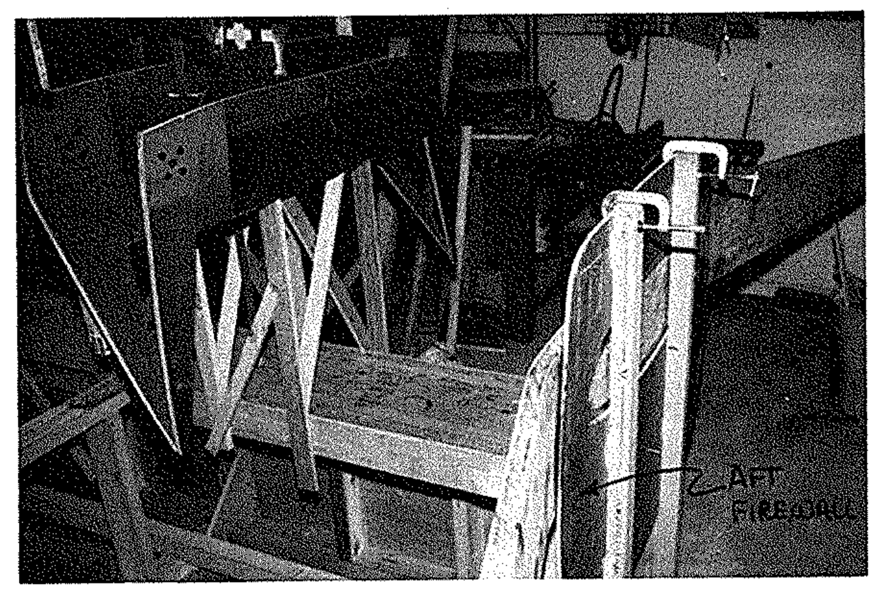

283. Use builders Dumpy Level or Transit - Leitz Model 11 or Sears Dumpy Level.



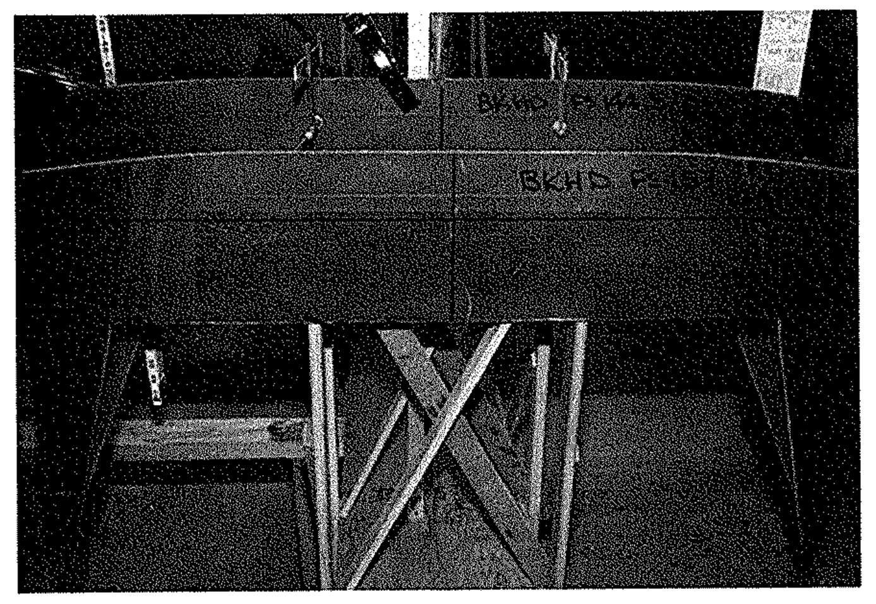
284. Position upright 1 x 2s at required locations to hold bulkheads. Note added rail on table to receive uprights. MAKE SURE CORRECT FACE OF BULKHEAD IS USED.


285. After centersection spar and firewall have cured, attach to end of stiff back and work from this point.

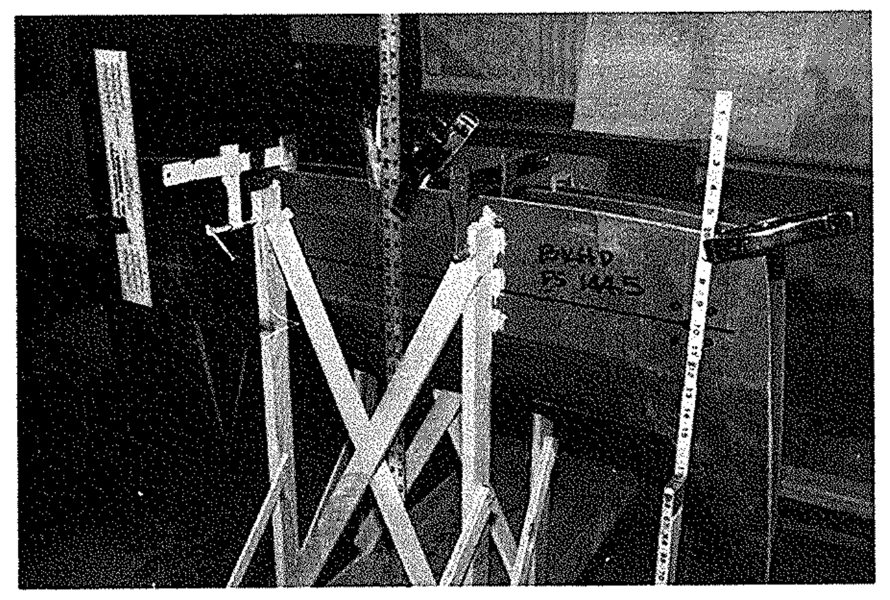

286. Cutting threads into MG-3.



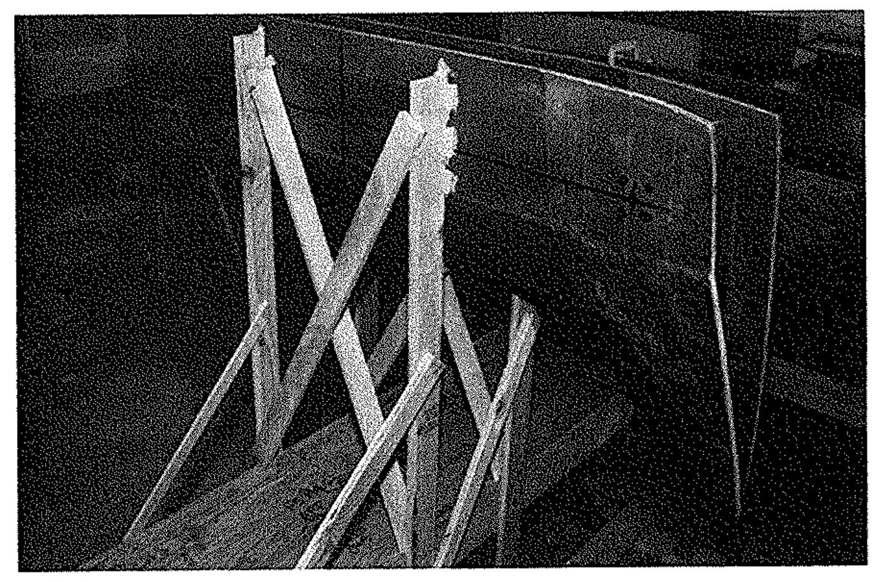
287. Setting up main gear Bulkheads (SEE D-33).

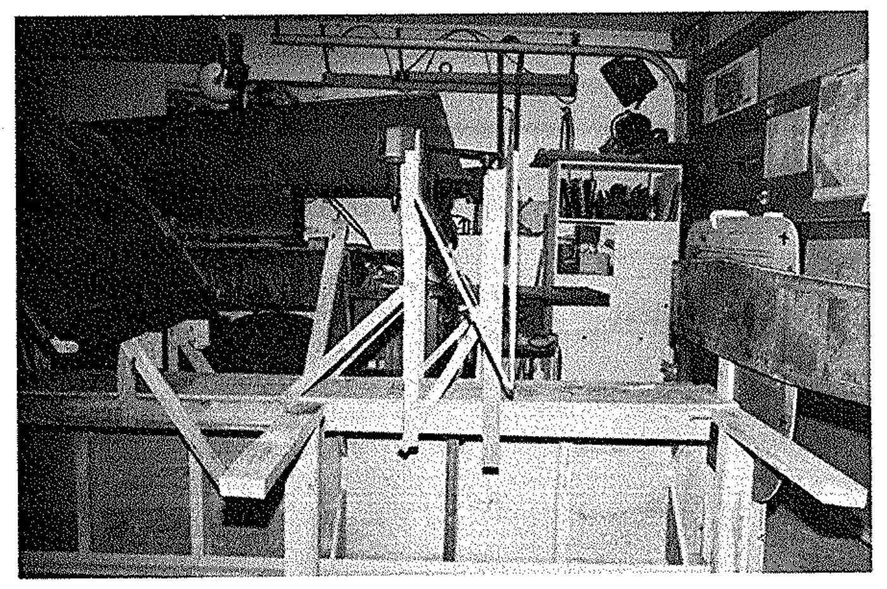


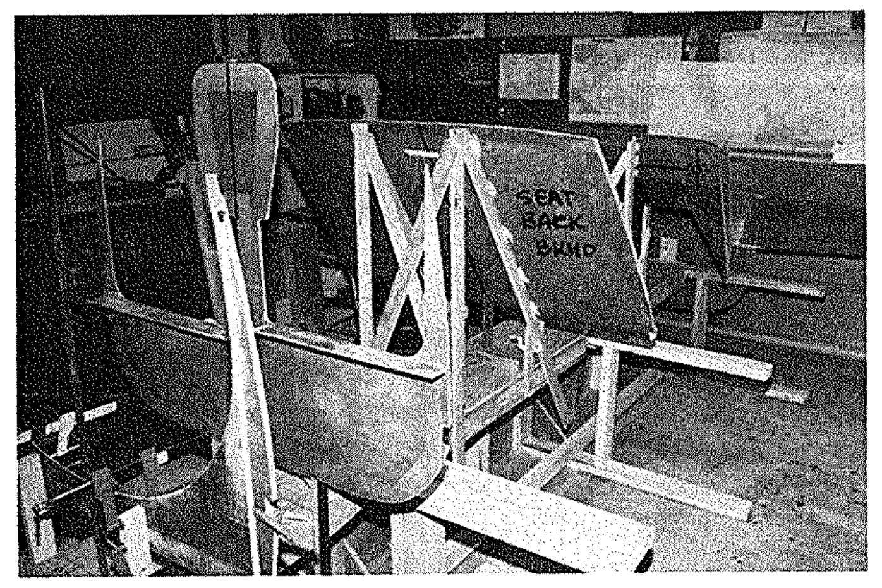
288. Use extreme care to align all bulkheads on center and at correct waterline. Remember everything is UPSIDE DOWN.



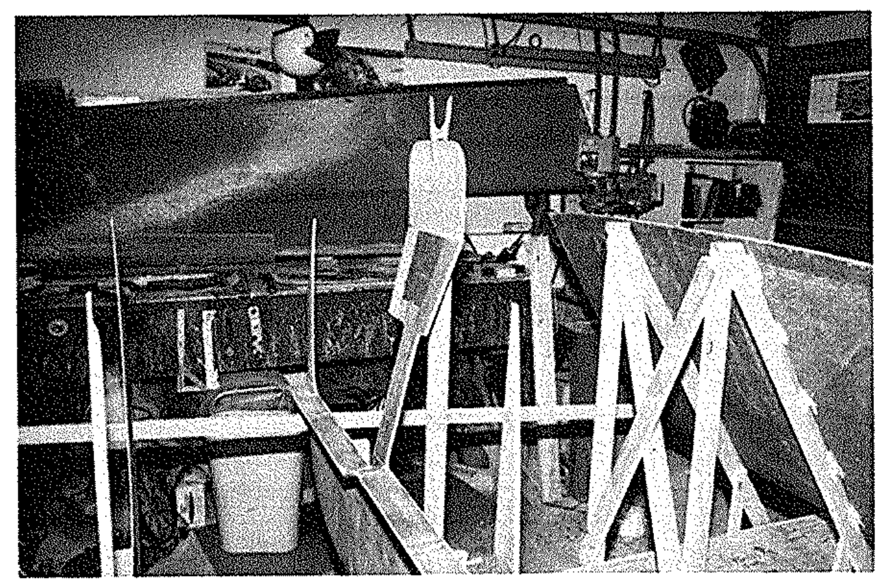
289. Continue of Photo #288. MAKE SURE CORRECT FACE OF BULKHEAD IS USED.

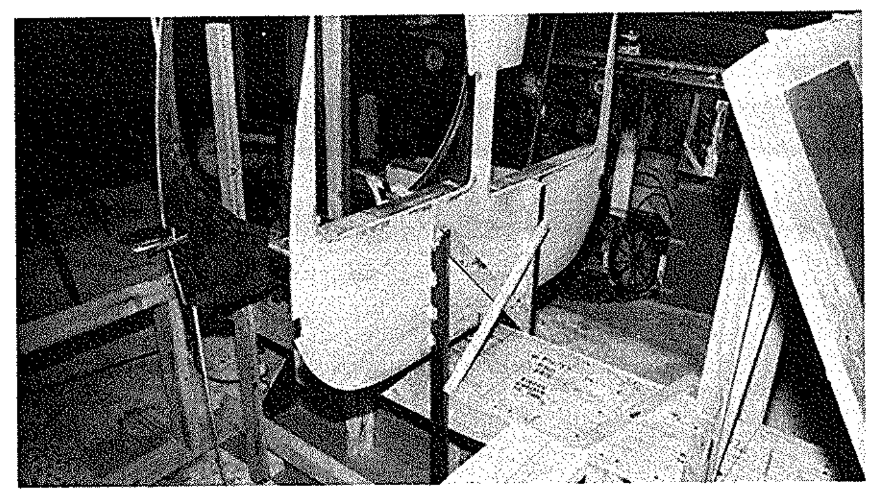

290. Main gear Bulkheads.

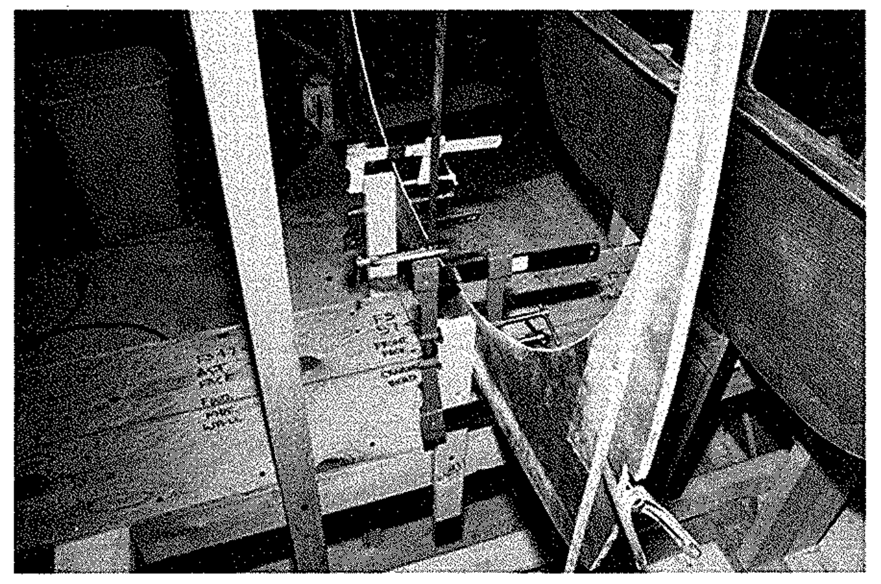

291. Side view of main gear bulkheads.

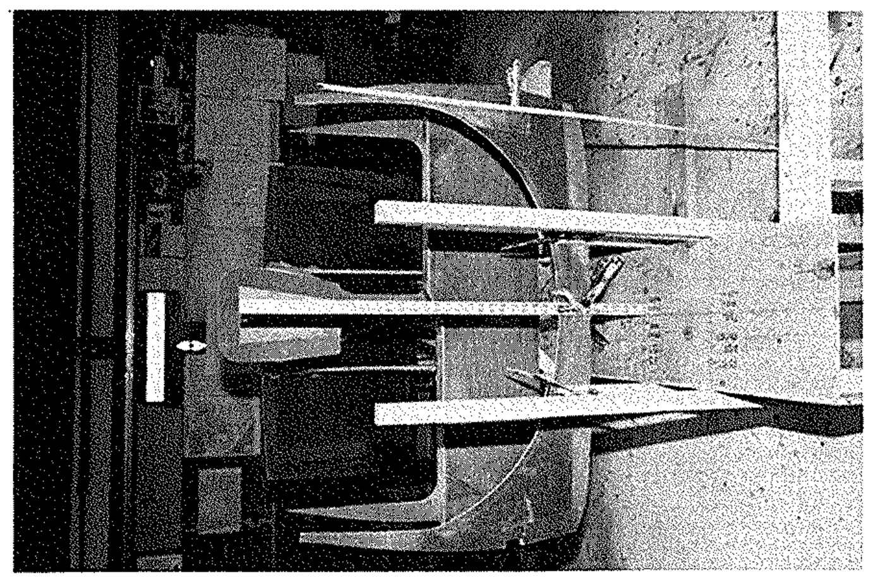


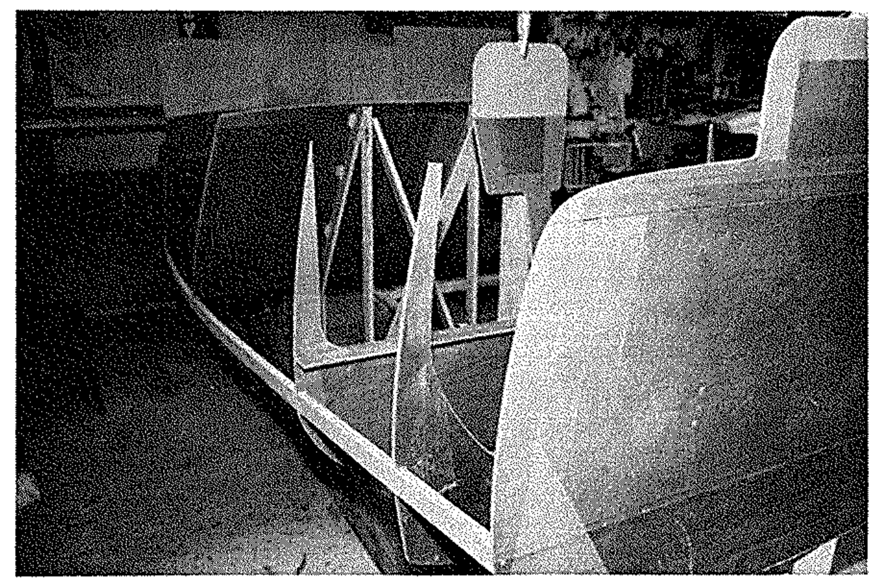
292. Canard attach, instrument panel and front seat back bulkheads.

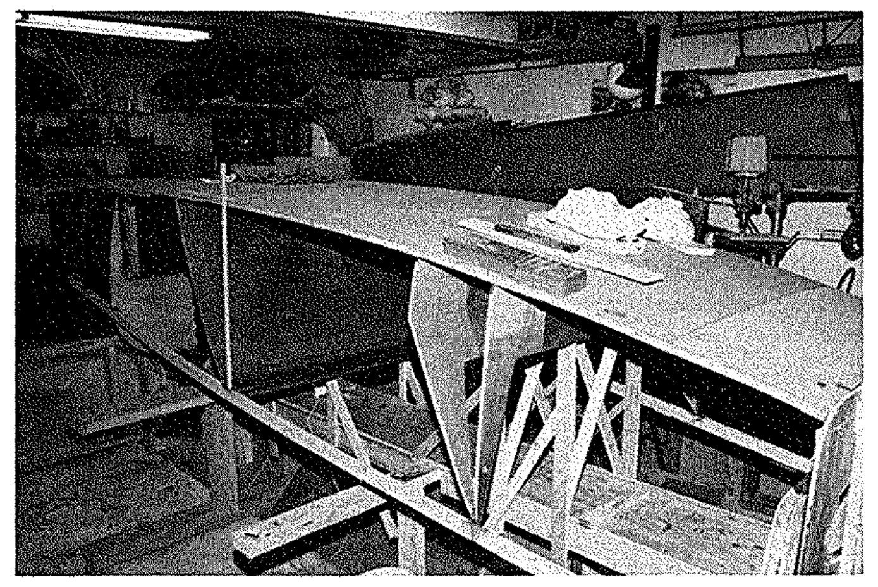

293. Instrument panel. Note how center leg is slanted aft.

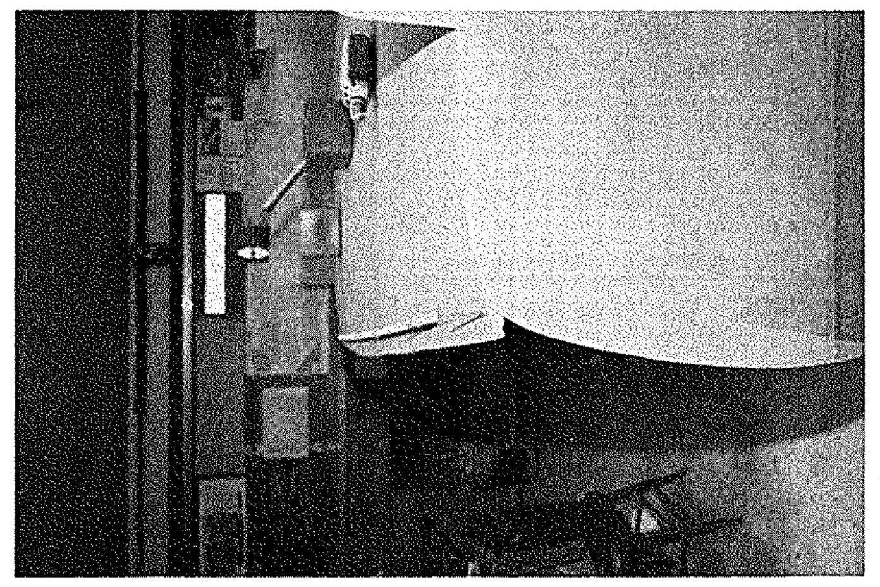

294. Instrument panel and canard attach bulkheads. MAKE SURE CORRECT FACE OF BULKHEAD IS USED. (SEE D-33).

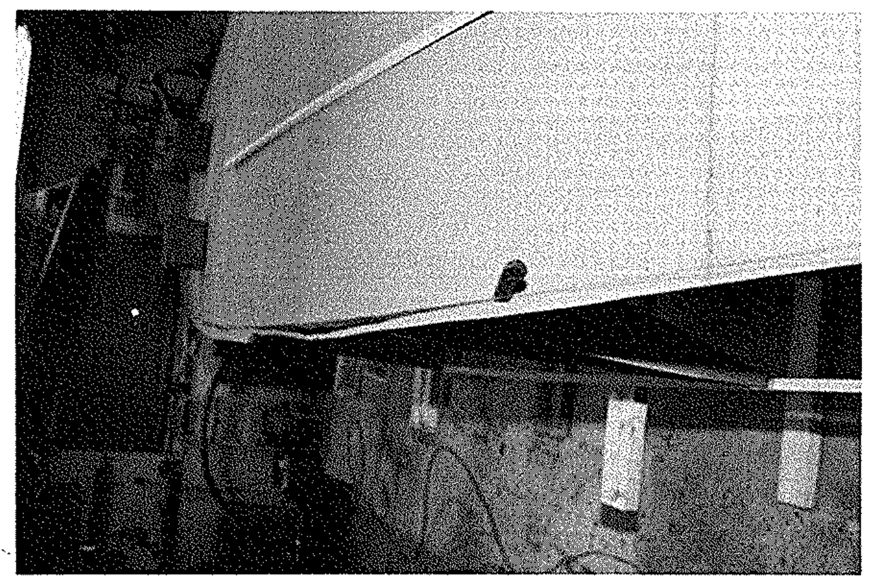

295. Canard attach Bulkhead. Use extreme care in proper alignment of center line and water line.

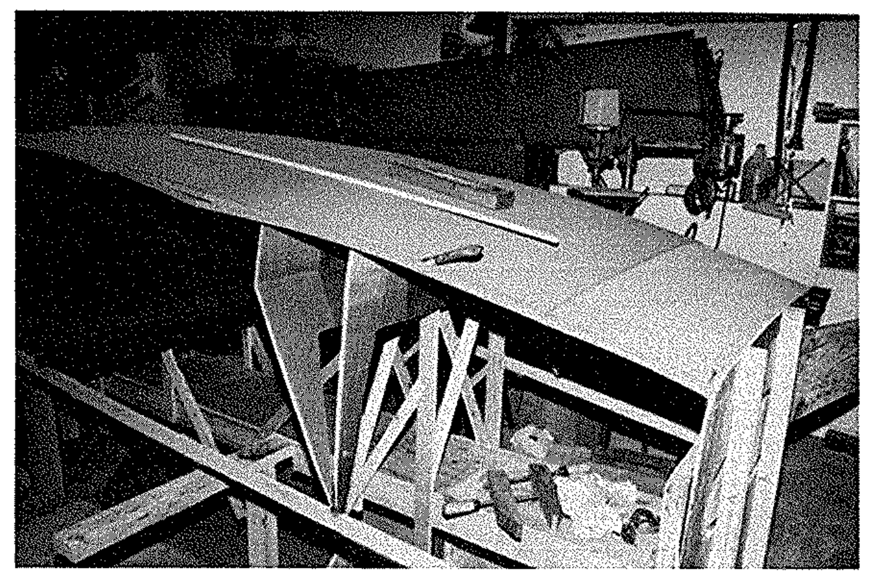

296. Canard attach and instrument panel.

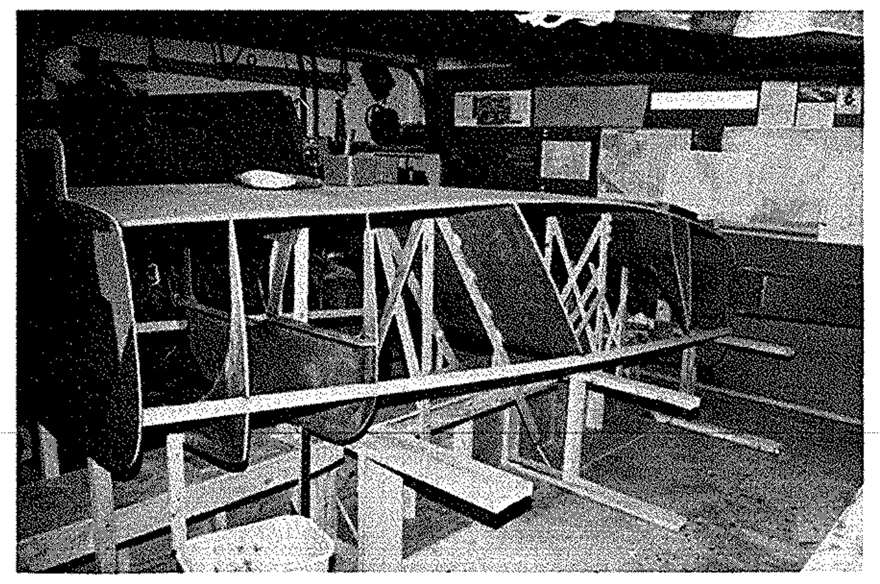

297. With FORWARD firewall and spruce longeron added.

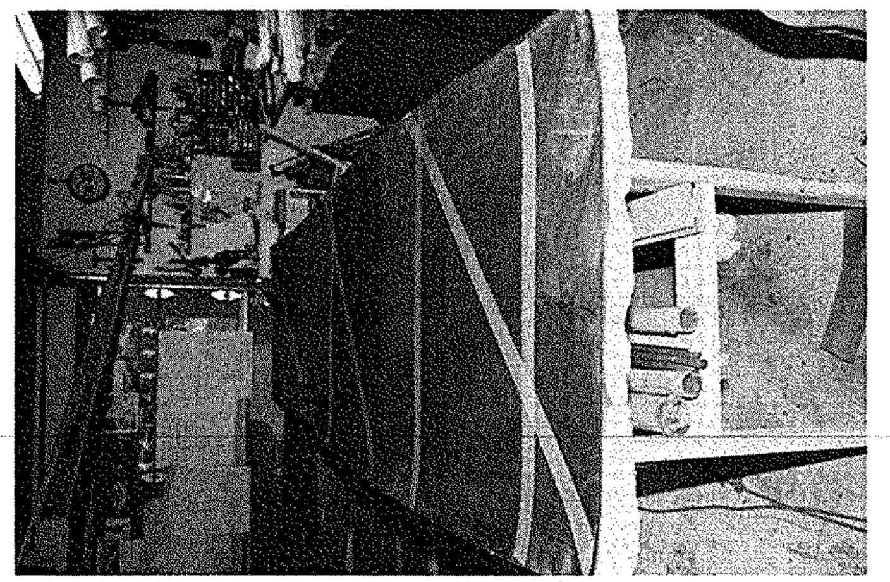

298. Hot glue 4 sheets of 5/8" R45 together to form large bottom sheet as shown. (SEE D-34).

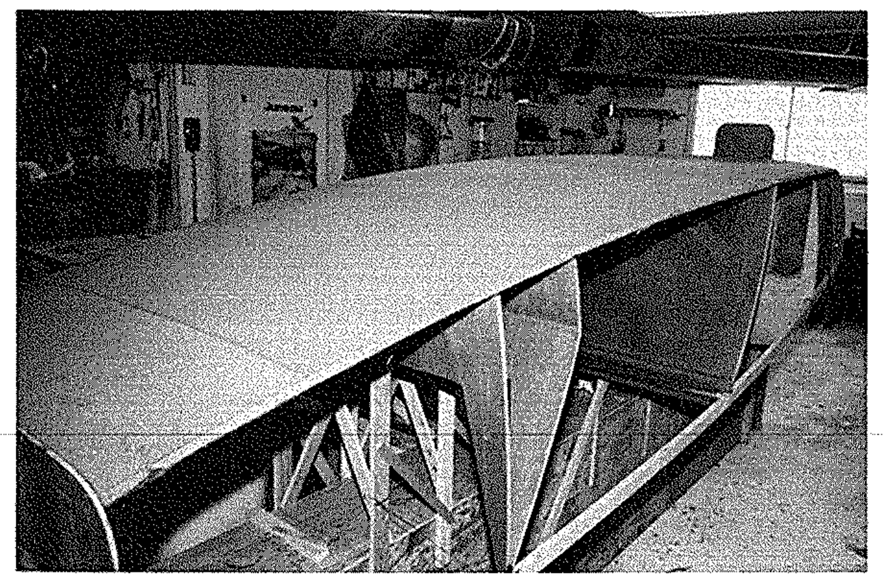

299. Trimming edges of bottom 5/8" foam to fit.

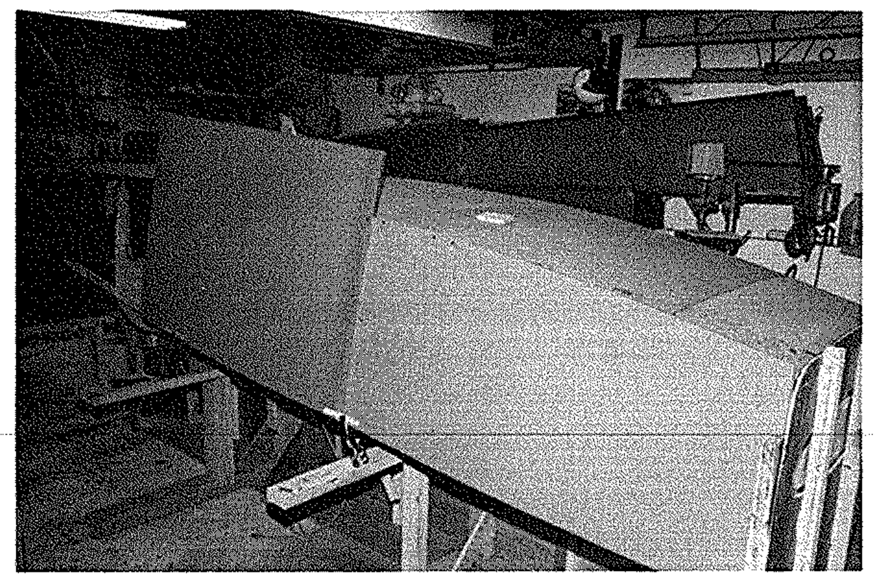

300. Trimming continued.

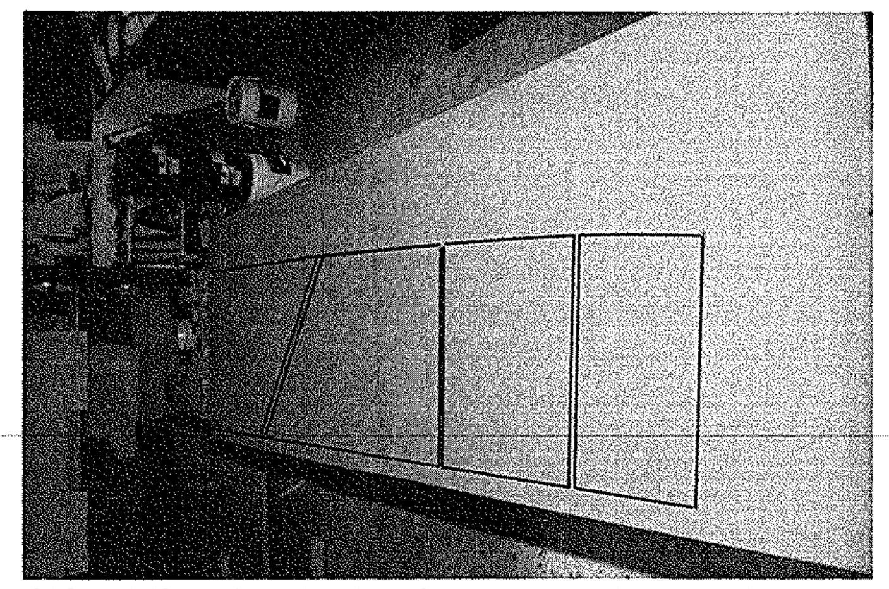

301. Use long strip of wood to form trim line.

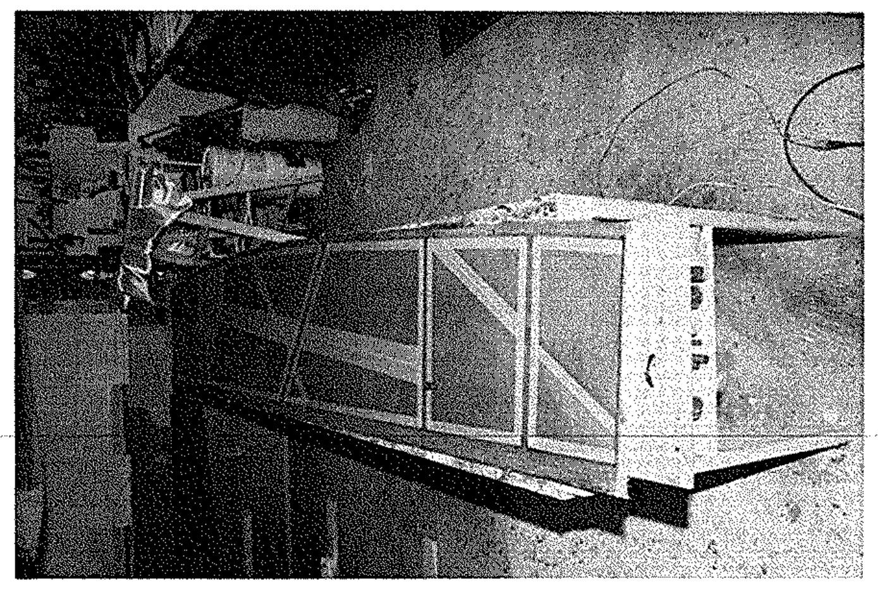

302. Using household iron on high setting, heat inside surface of foam bottom to form curve in foam as required to fit profile of bulkheads.

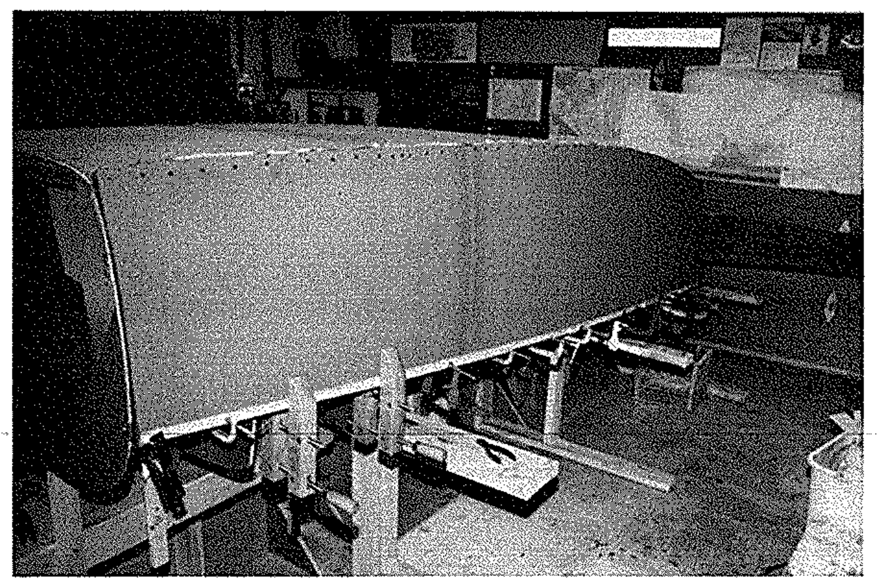

303. Note how edges of inside surface are curved up. Glass inside surface of bottom foam. (SEE D-34) Peel ply at each bulkhead location and BID JOINT.

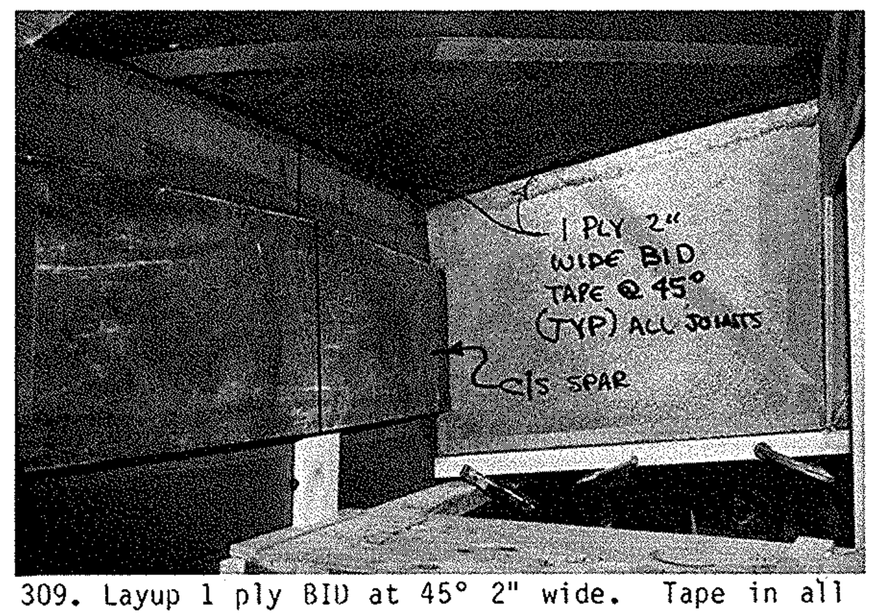

304. Remove peel ply from bottom and micro bottom to bulkheads as shown.


305. Form fuselage sides 5/8" R45 foam.

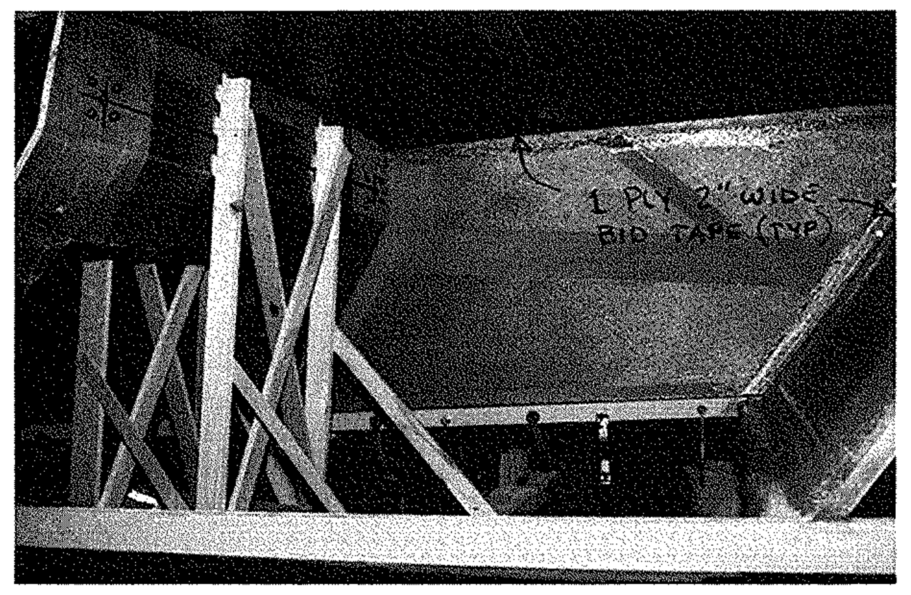

306. While side is in place, mark from inside the position of each bulkhead. FORM SHAPE OF Fuel right gauge before glassing inside of side wall.


307. Glass inside surface of sides with 1 ply BID at 45° and peel ply outside of each bulkhead, longeron and bottom.

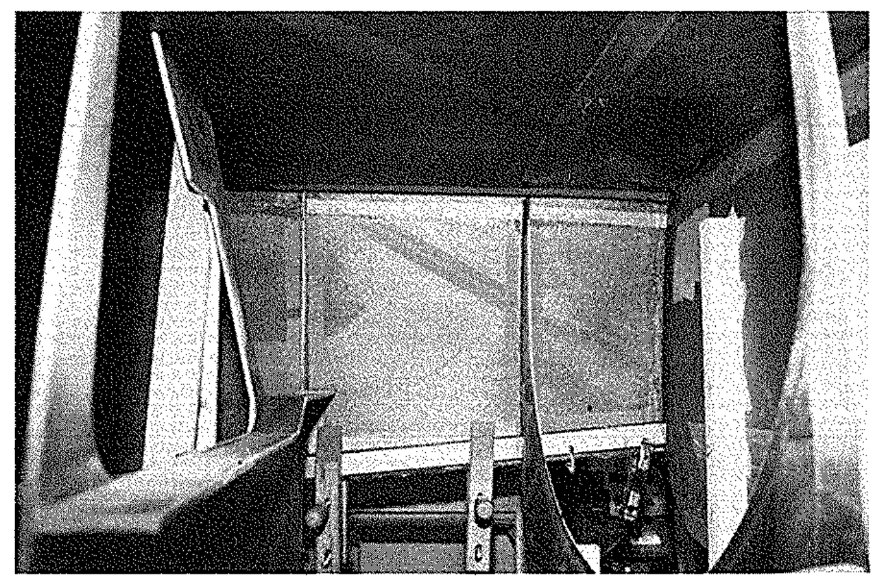

308. Apply micro to bulkhead edges and foam bottom and wet flox to longeron, place glassed side panel in place while tacky. Use nails and clamp to hold in place.

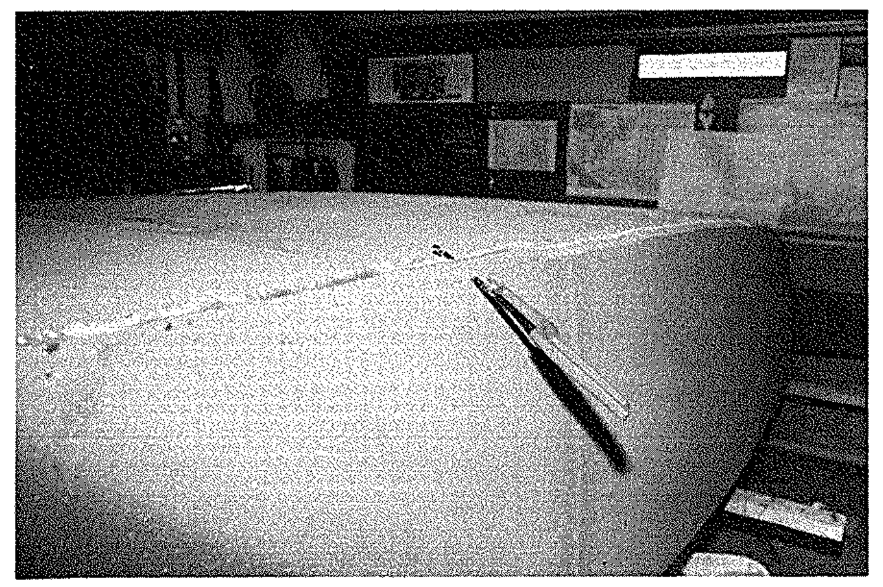


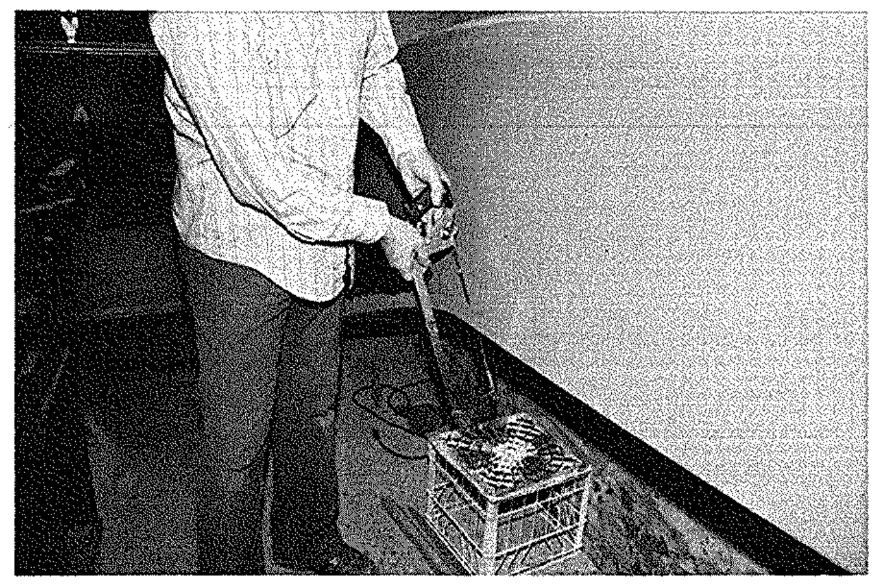
309. Layup 1 ply BID at 45° 2" wide. Tape in all joining surfaces throughout inside of fuselage with exception of canard attach and main gear bulkheads which have added plies.

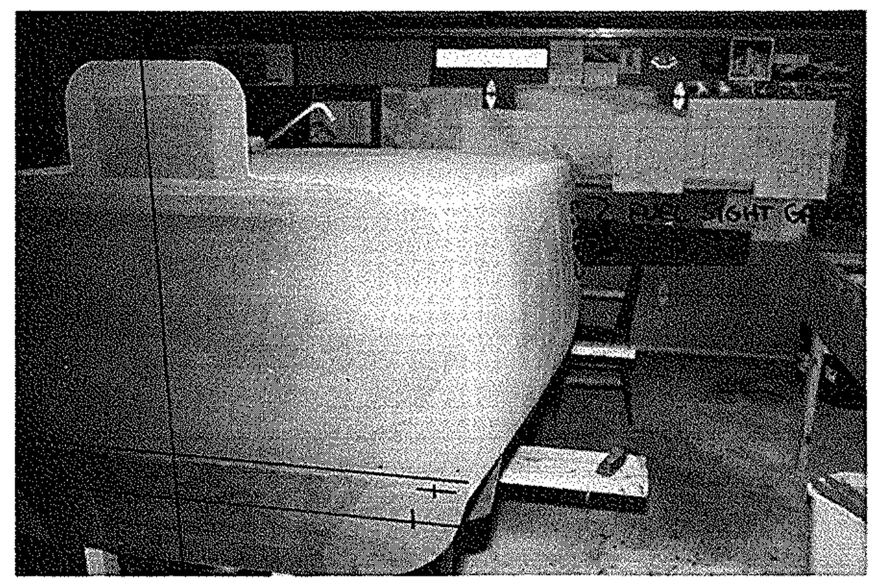


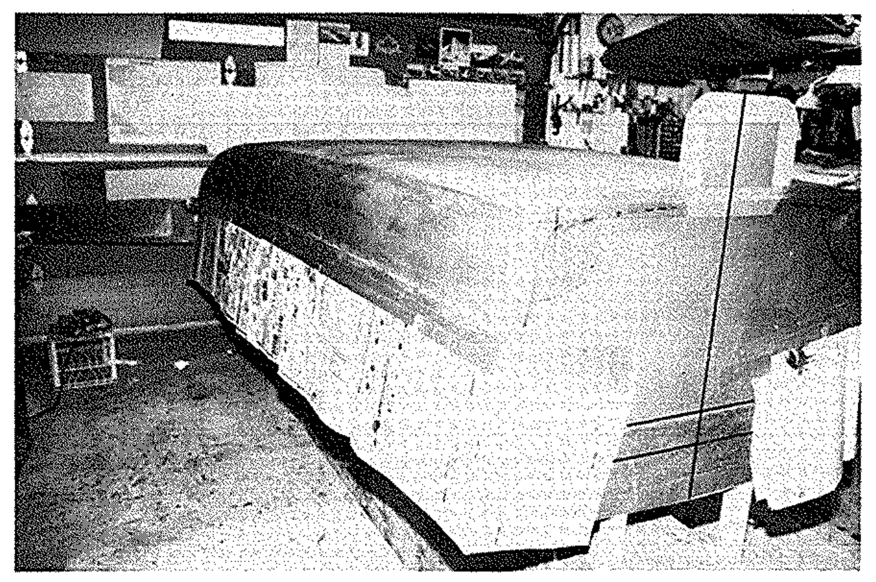
310. Inside view of side panel.

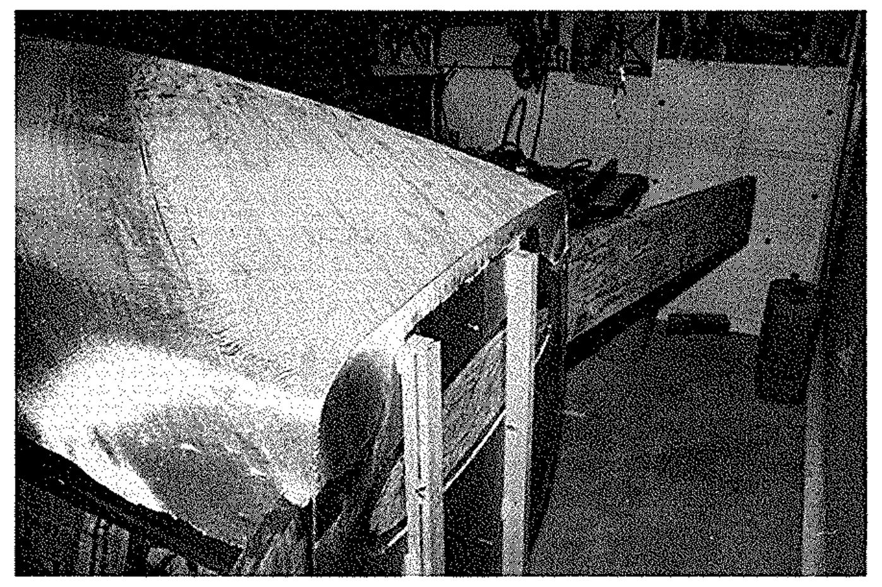

311. Continue inside view of side panel. Note how center leg of instrument panel is slanted AFT.

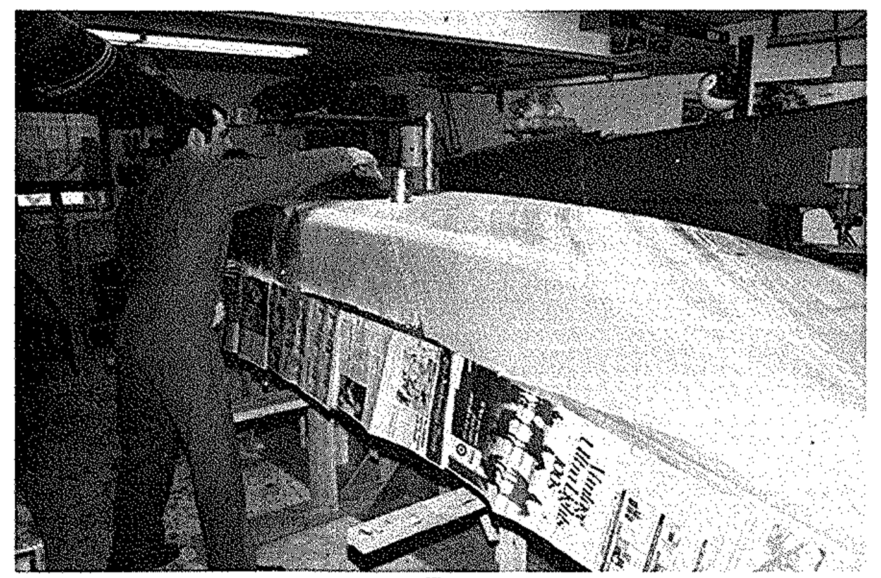

312. Trimming corner of fuselage. Use hack saw blade to rough cut. Finish with SURFOAM FILE and sanding block.

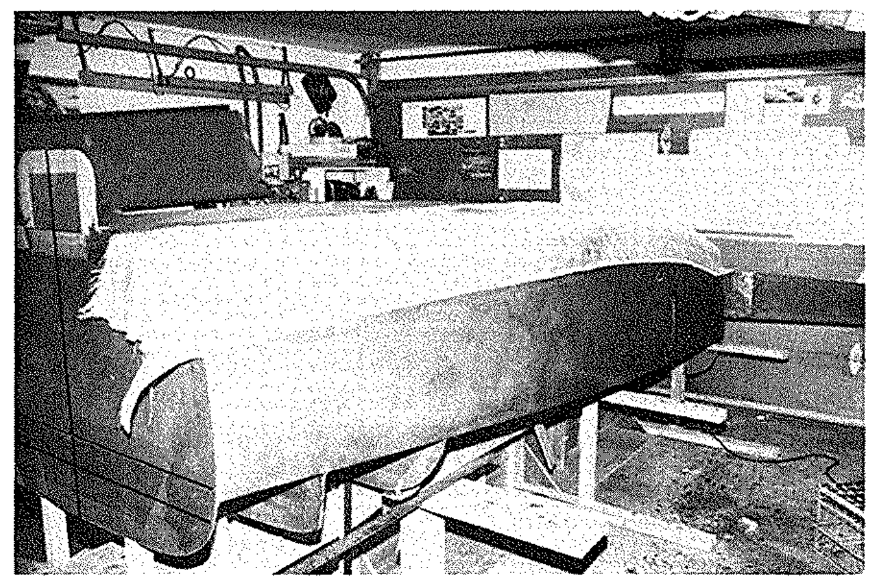

313. Shaping upper edge of fuselage sides. Carve and shape areas for fuel sight gauges in sides of fuselage. (SEE Section A-A, D-34).

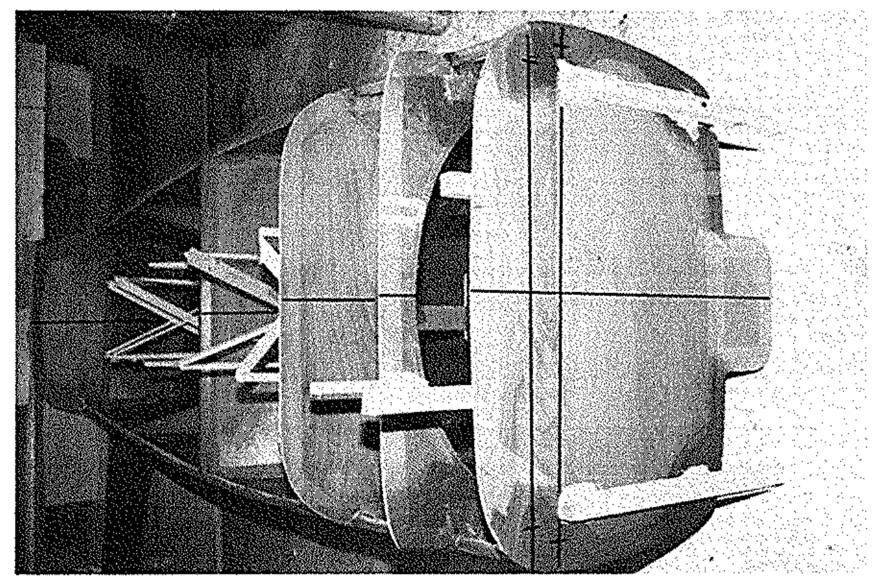

314. Sides after shaping - ready for skin. Carve area for fuel sight gauges. (SEE Section A-A D-34)

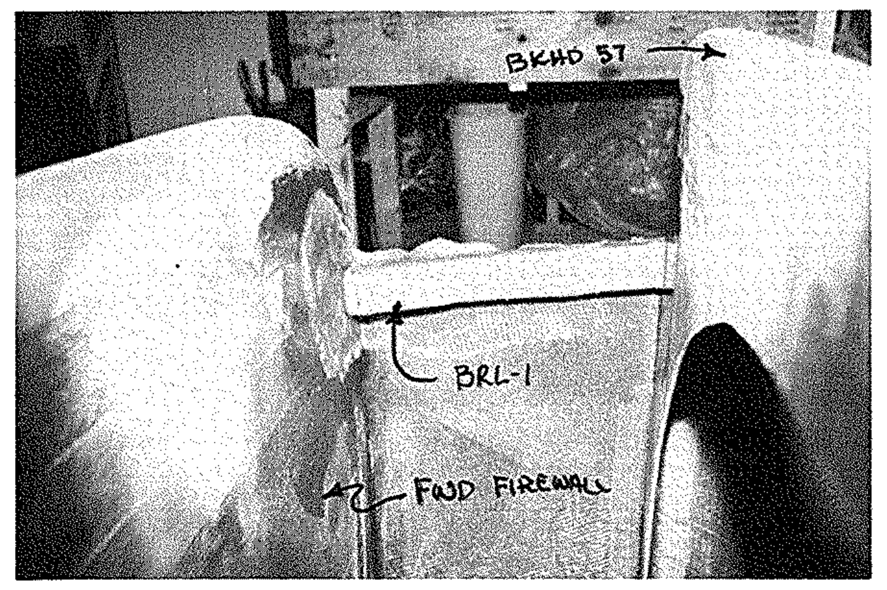

315. Cover sides of fuselage below skin layup #1 to keep clean. Do you have your fuel sight gauge installed?


316. Note 45° orientation of UND and how layup laps onto firewalls.

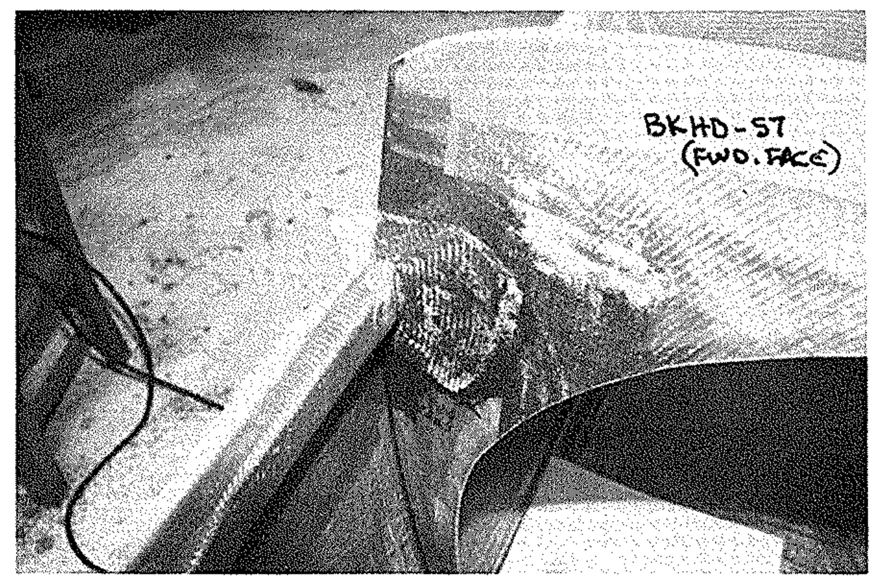

317. Wetting out layup ①, trim edge of UND above protective paper.


318. Do side layup ② and ③ and the layup (2A) and (3A).

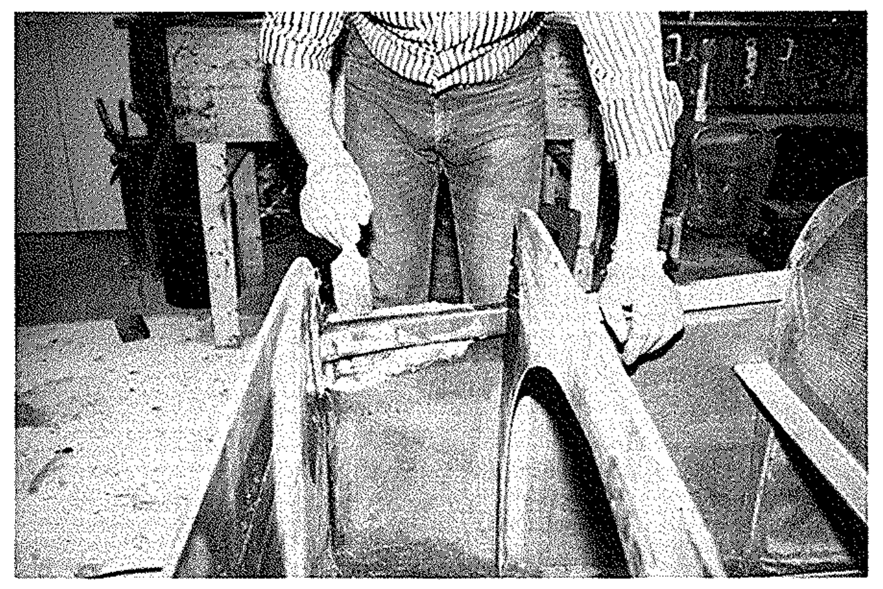

319. After skin cure, install legs to hold fuselage off floor and remove from stiff back. Torsional strength of "tub" is very weak until placement of turtle deck and main fuel tanks.

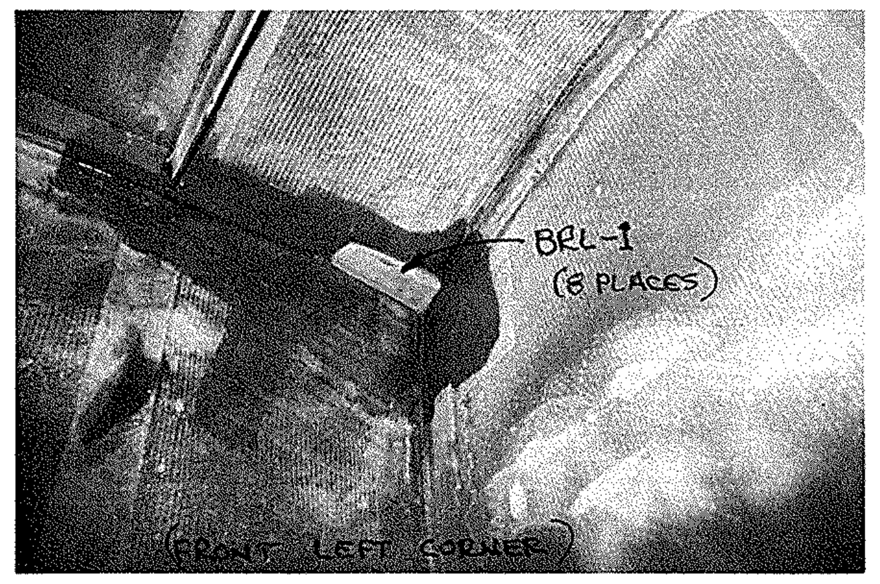


320. Begin reinforcing layups in all corners and attach points. (SEE D-34).

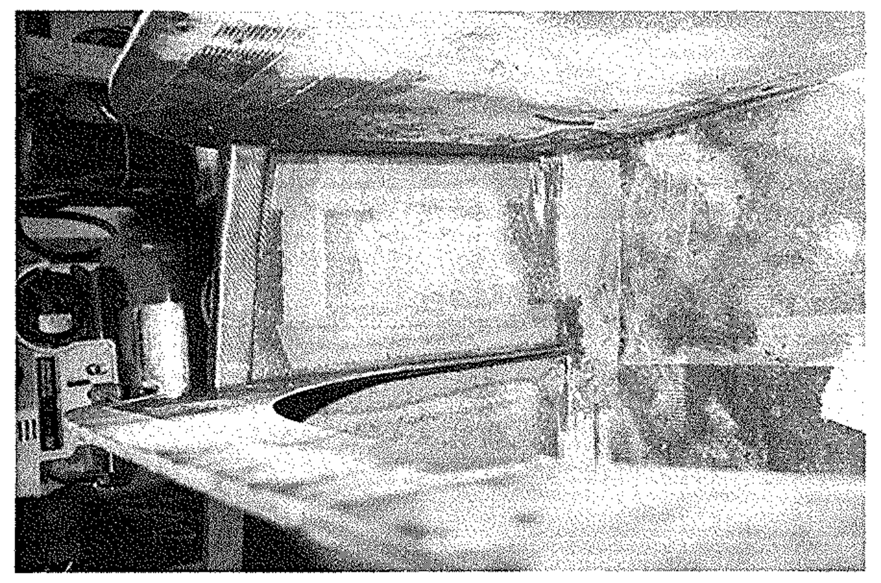


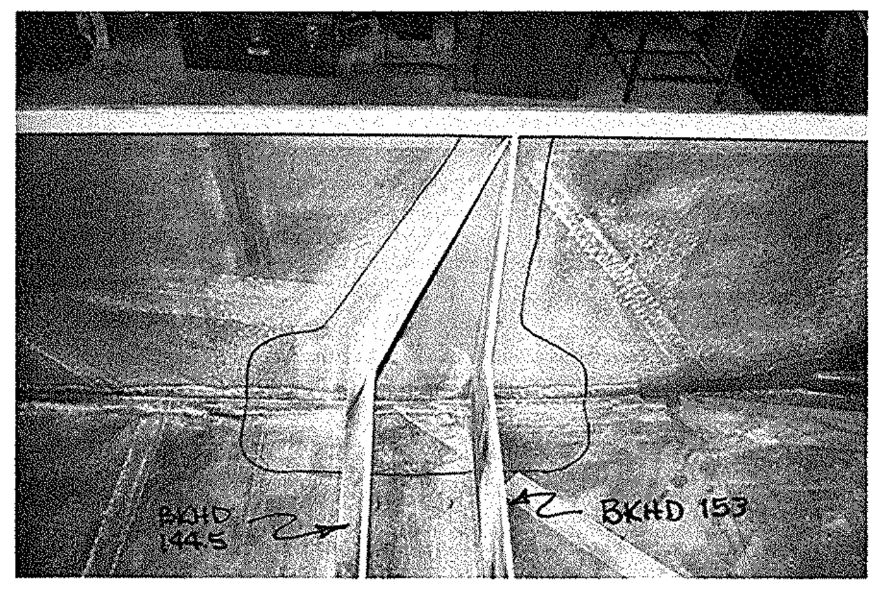
321. Reinforcing layup.


322. Stippling 8 plies BID reinforcement.

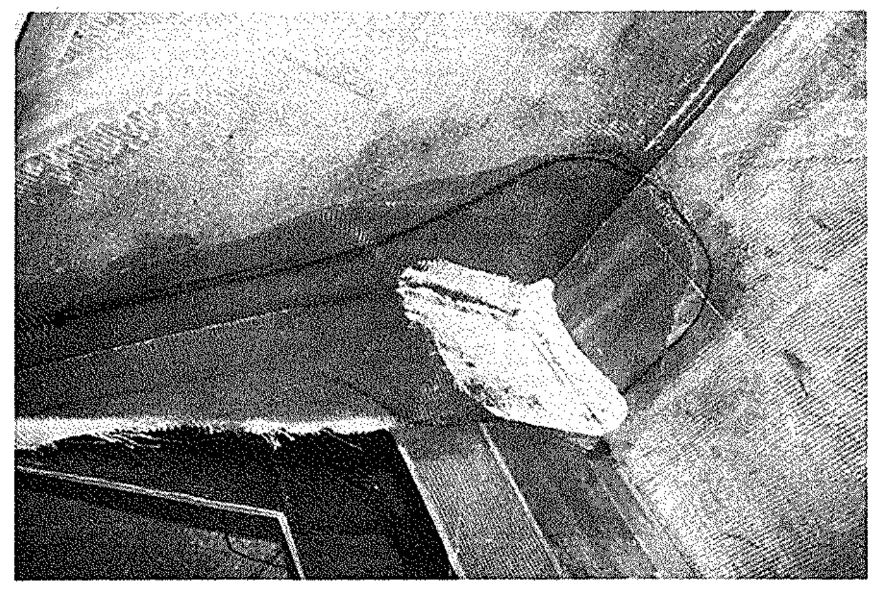


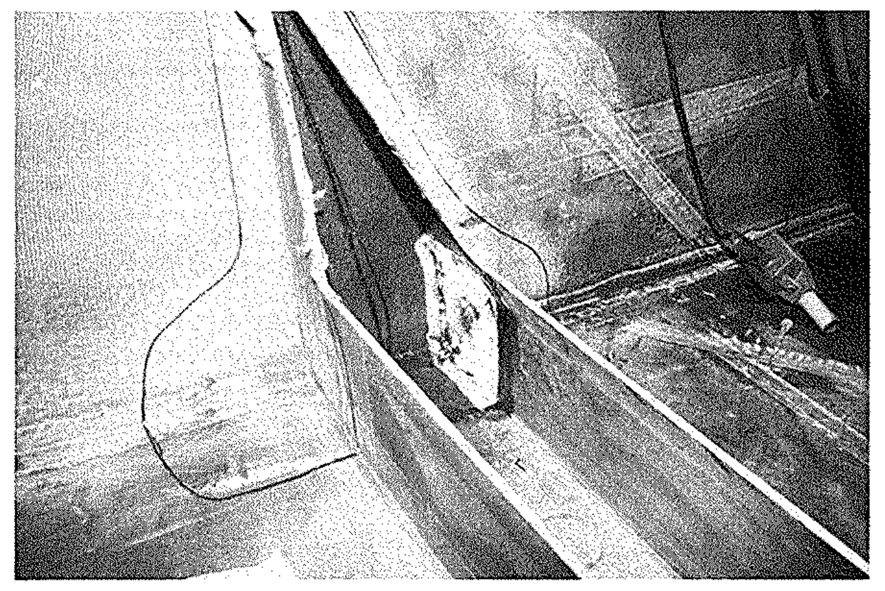
323. Placing BRL-1. Custom fit each BRL-1 (8 places) at each motor mount location. Flox in place and proceed with reinforcement layups on D-34.

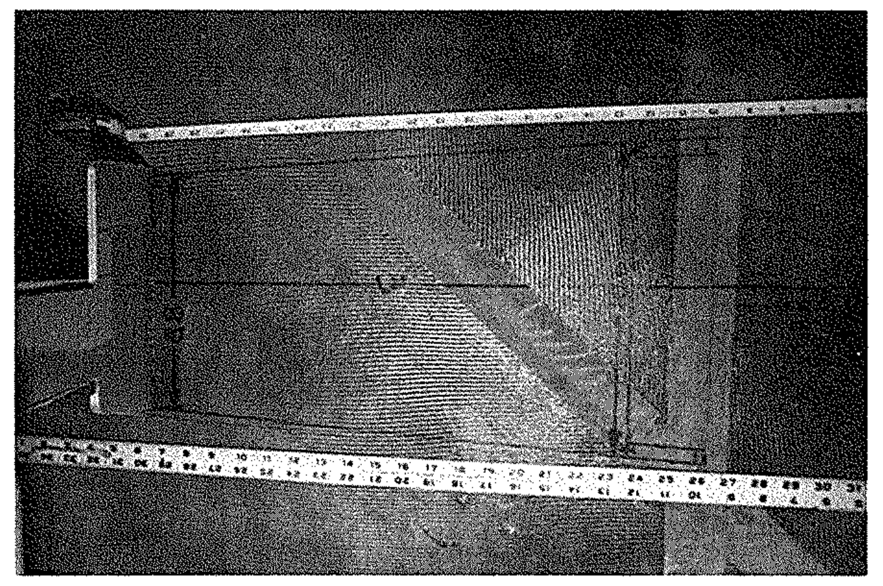

324. Front left corner of "tub" (fuselage) after placement of BRL-1 at each mount location and 8 plies BID tapering to 3 ply BID reinforcement has been installed.

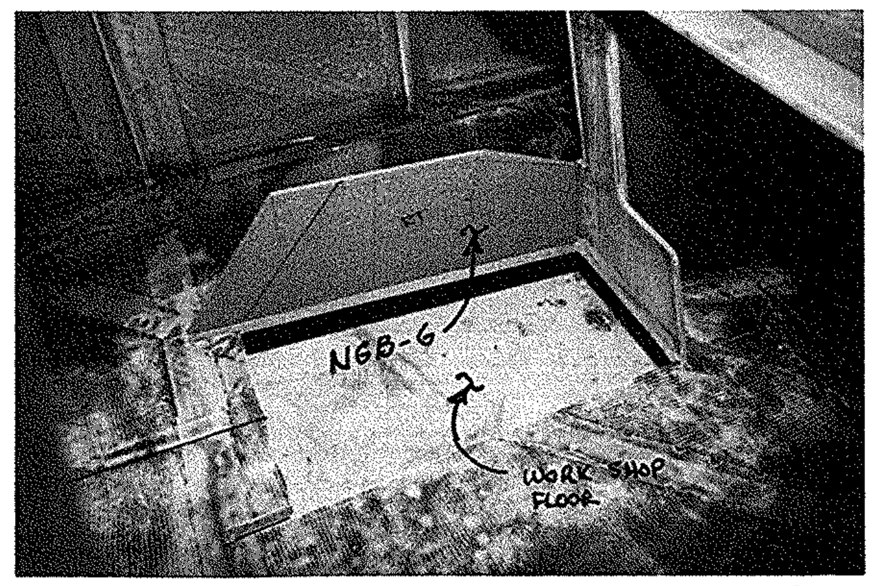


325. RIGHT side of main gear box with outline of reinforcement layups as shown in details on D-34.

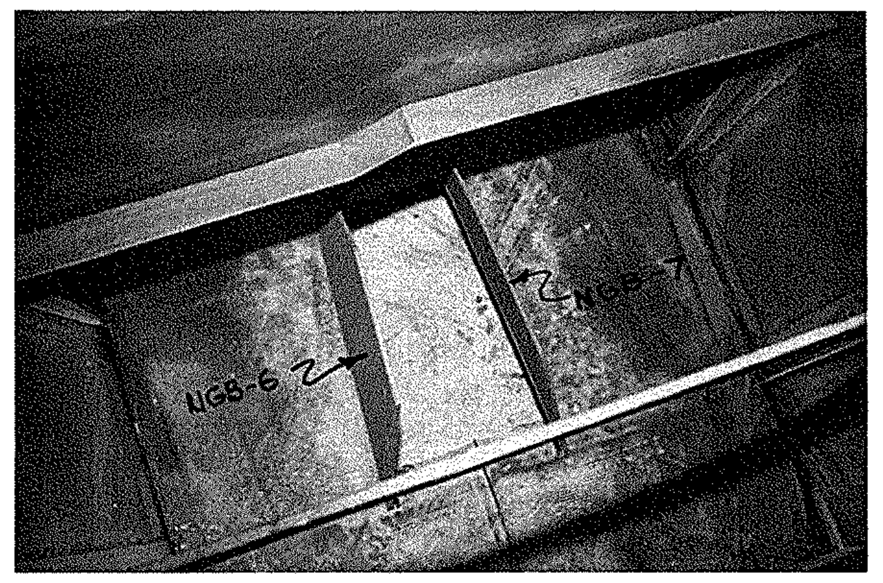

326. LEFT side main gear box with BID reinforcement before wetting out so it would show better in photo. Wet out all layups.


327. Opposite side of bulkhead F.S.144.5 as shown in Photo #326. Wet out all layups.

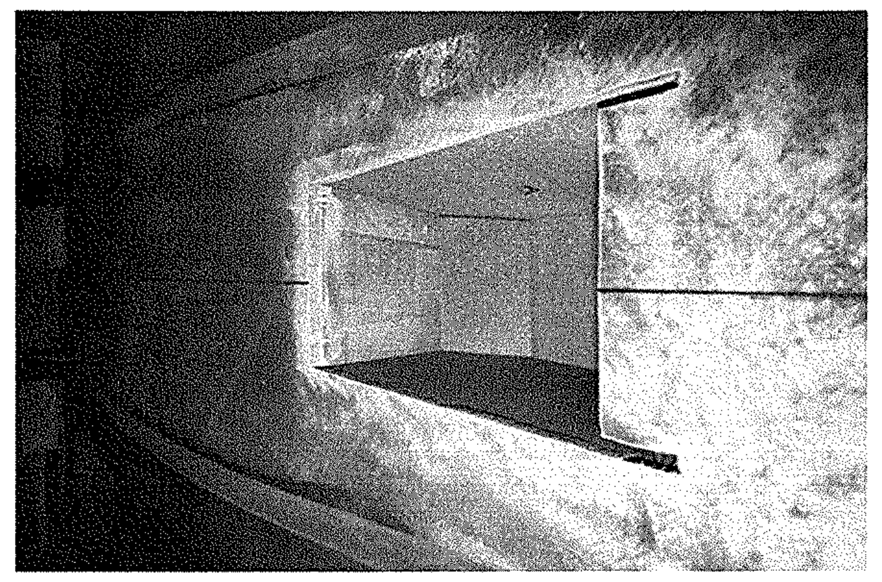

328. NOSE GEAR BOX. Shows outline of nose gear box opening in fuselage floor from the inside. Note plans (D-36) give dimensions and details from outside with 'tub" upside down. Carefully study details. NOSE GEAR IS OFF SET 4" TO THE LEFT.

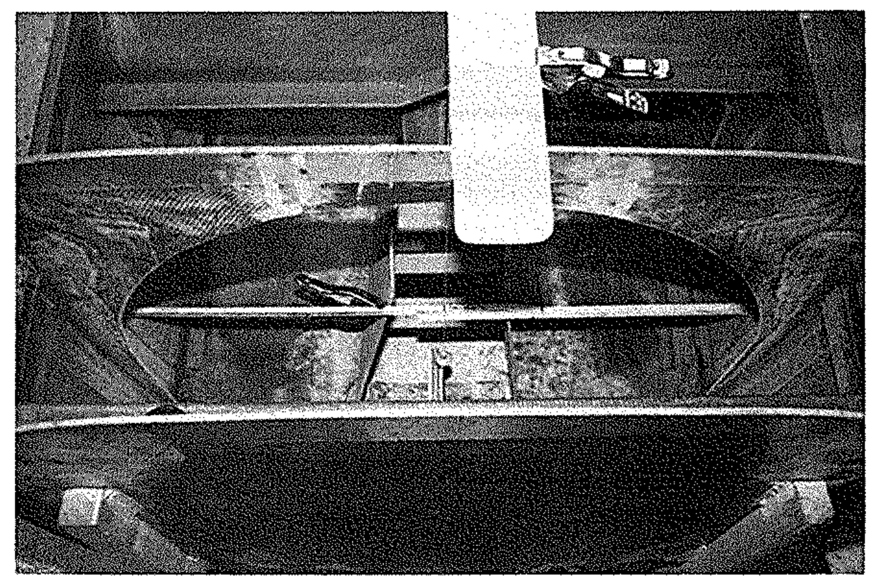


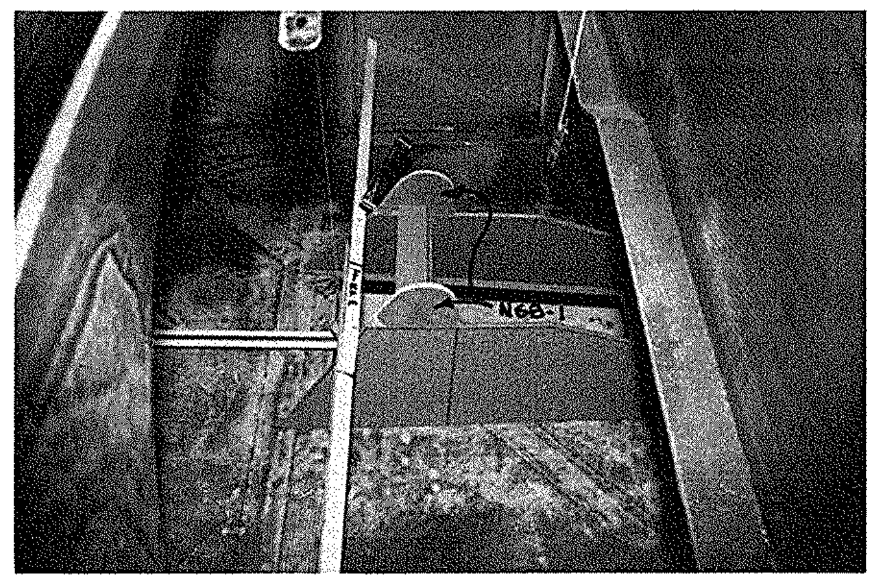
329. Nose Gear Box. After cutting opening in floor of tub build upper gear box using hot glue to hold foam parts in place.



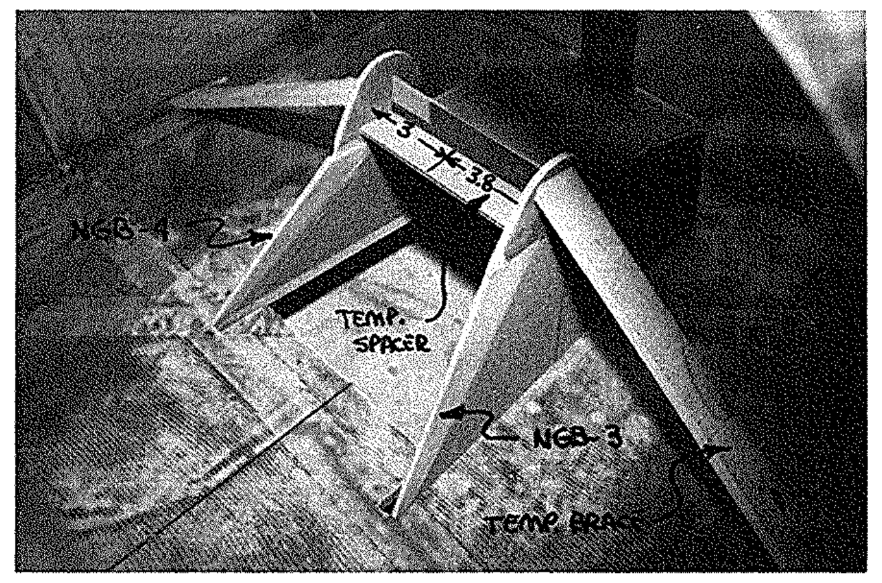
330. Nose Gear Box. Upper portion.


331. Nose Gear Box. Upper portion as viewed from bottom of fuselage. Note offset of box.

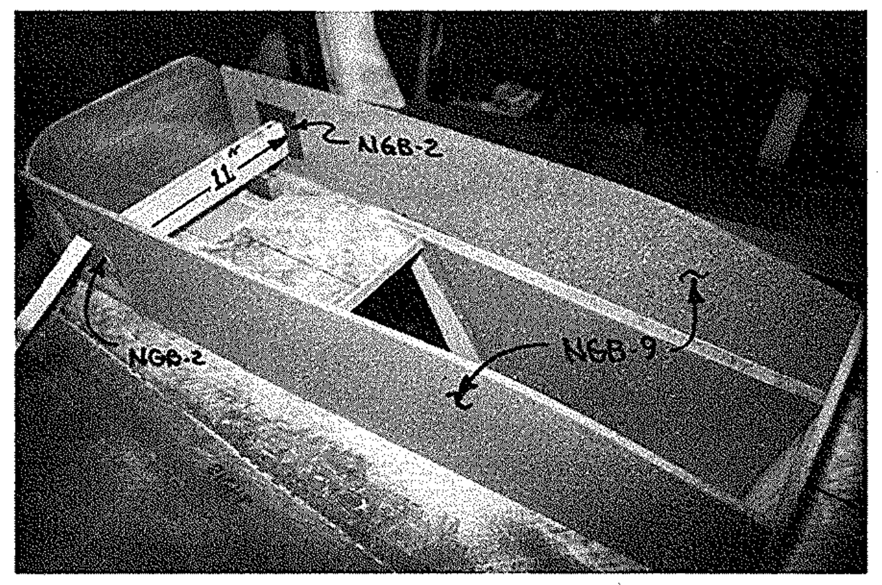

332. Carefully align all parts of nose gear box. Carefully study Section A-A detail on Page D-36.



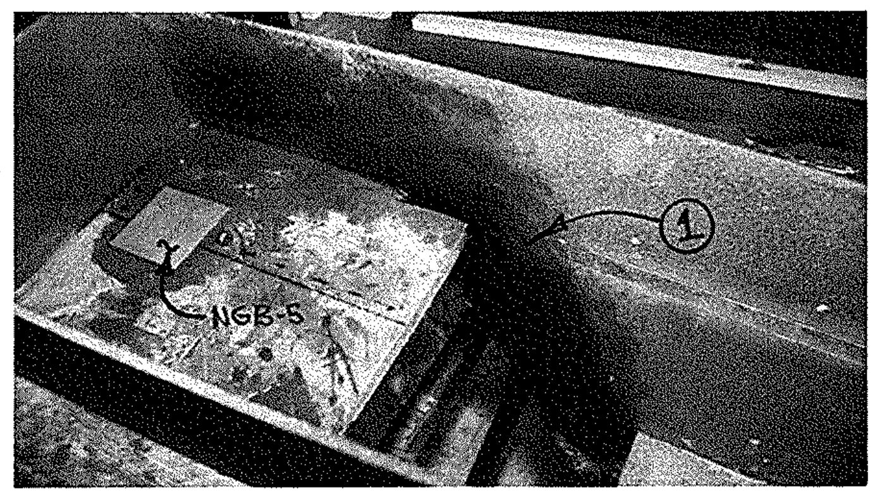
333. Aligning and centering nose gear box.



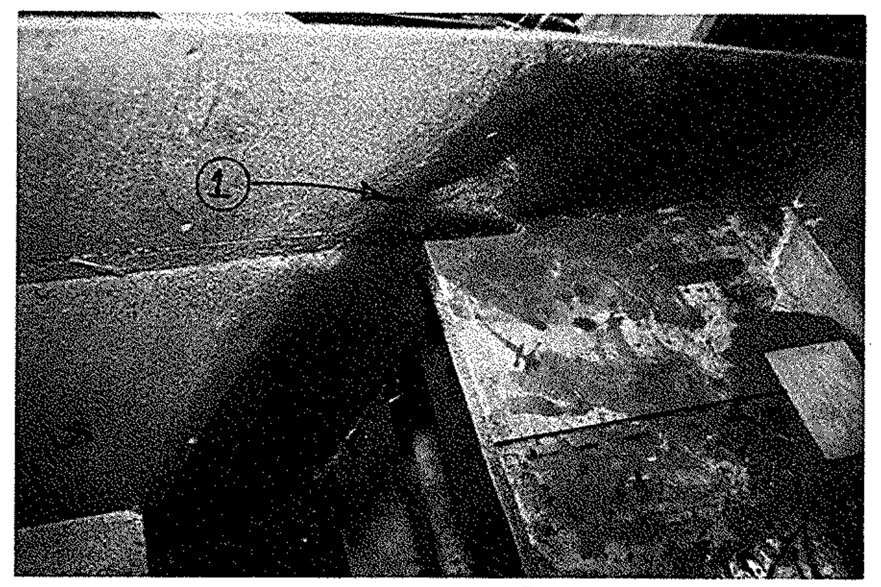
334. Once aligned hold position of upper nose gear box with braces.



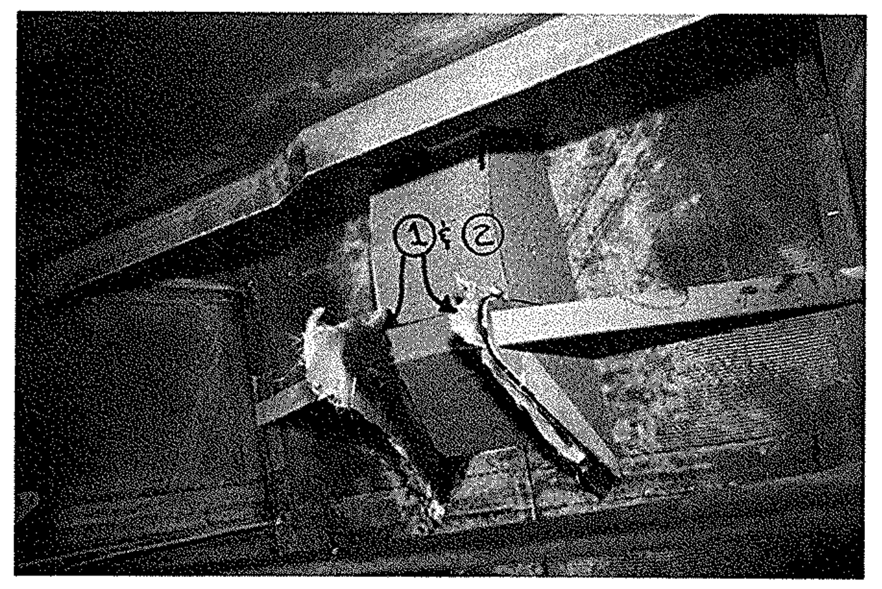
335. Turn fuselage over and construct lower portion of nose gear box. Place 11" spacer between NGB-2 to hold exact measurement.



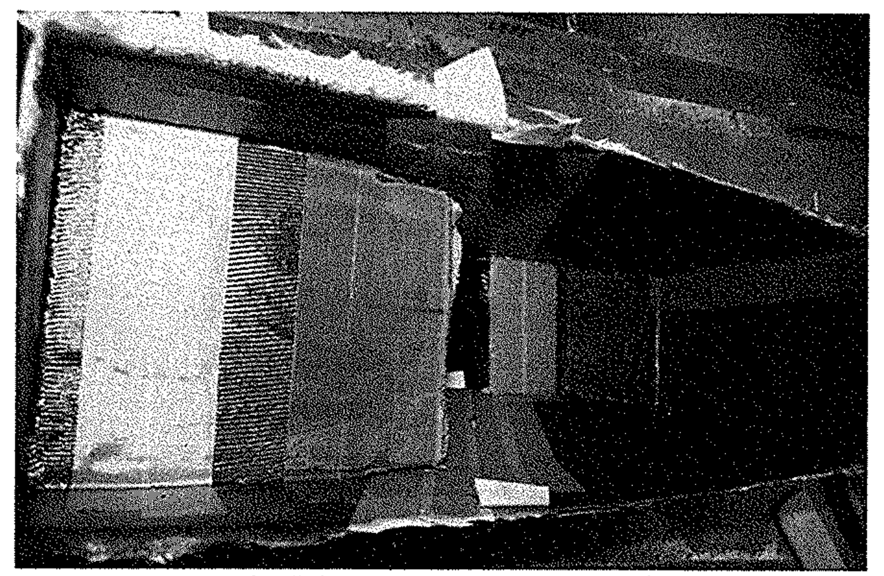
336. Attach small braces on outside and remove 11" spacer. Do layup ①. Peel ply layup. See Photo #337 for other side of box. Flox NGB-5 in place.



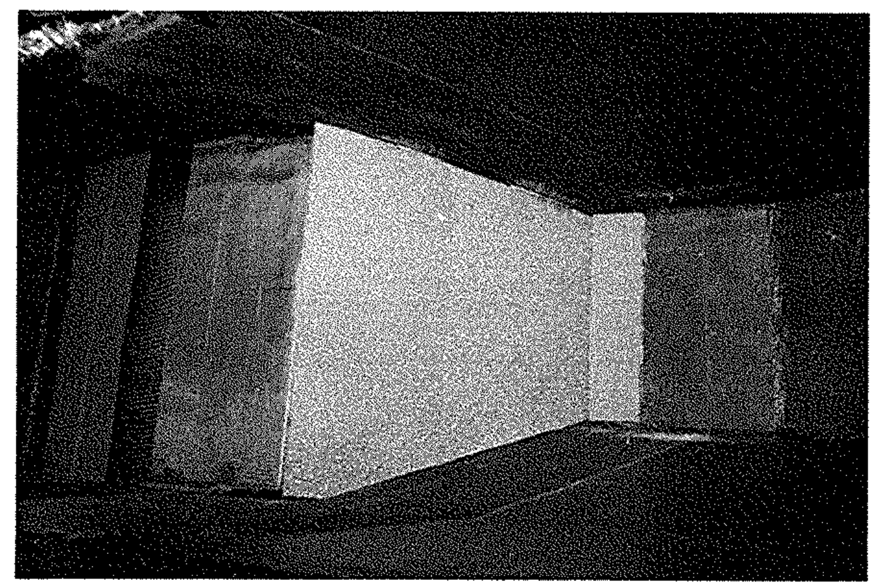
337. Nose Gear Box. Layup ① opposite side of Photo #336. Peel ply layup.



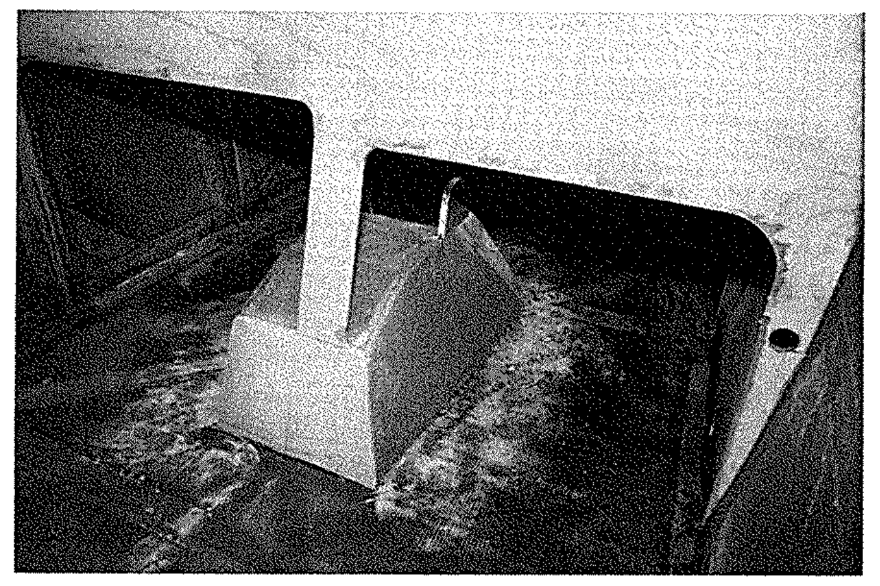
338. Layup ① and ② completed with front cover in place. (SEE photo #340 and D-39).



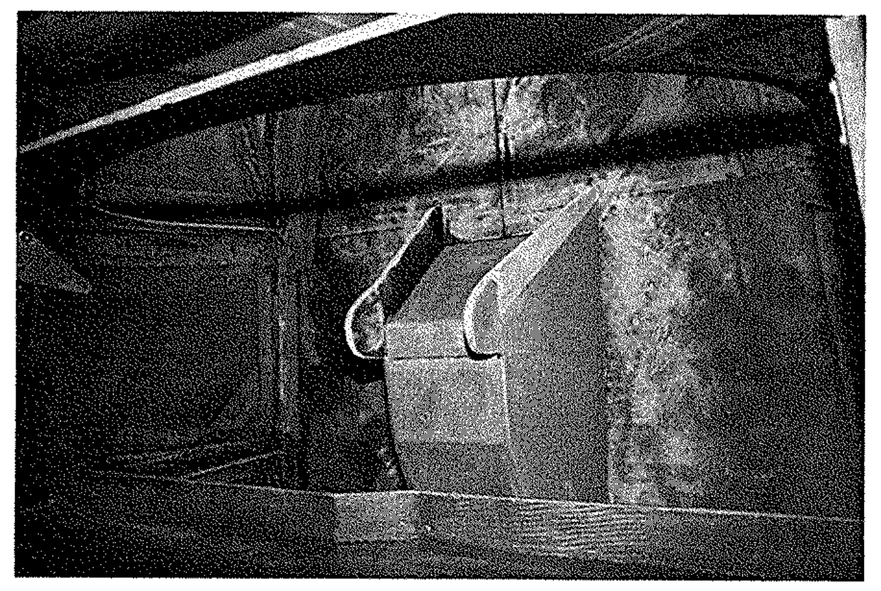
339. Layup ②④ plies BID at 45° covering entire inside surfaces of box. Also extending onto NGB-1 ears and covering layup #1.



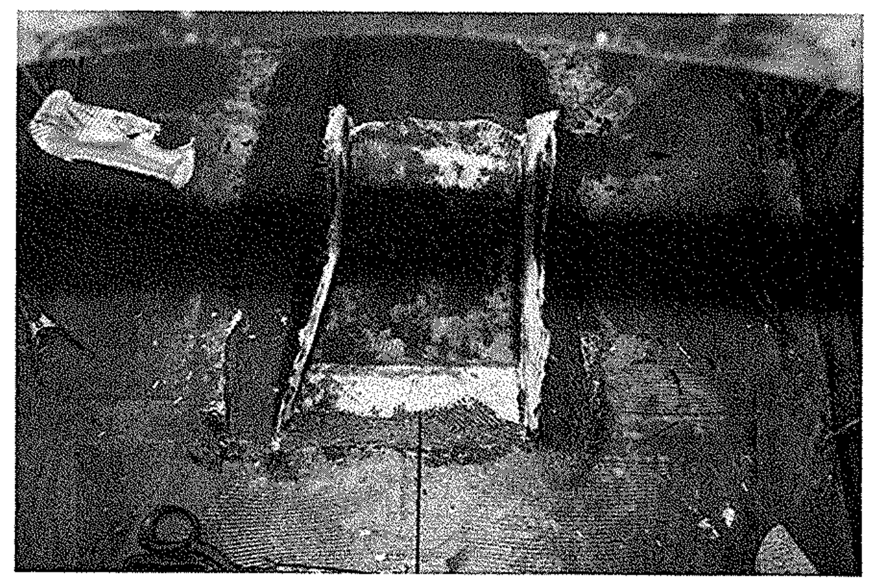
340. After layup ② install front cover. Note: No patterns for nose gear box covers are in plans. Make to fit out of 1/4" R45.



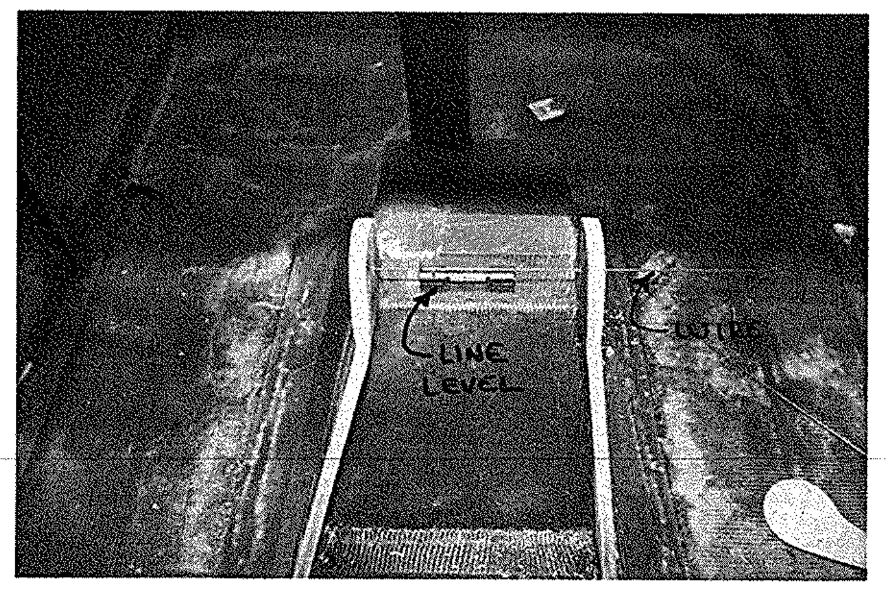
341. Quarter view of box before outside layup ⑤.



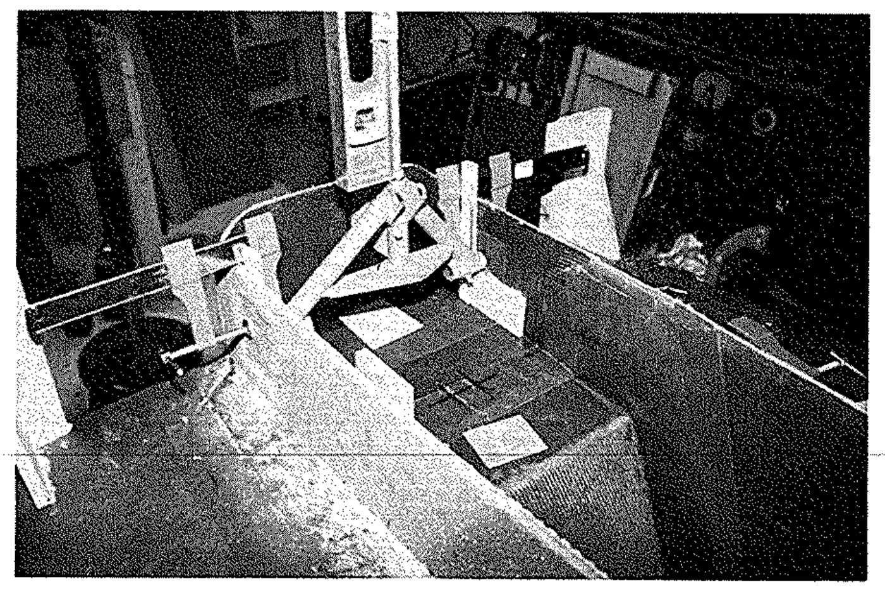
342. Top side view before layup ⑤.



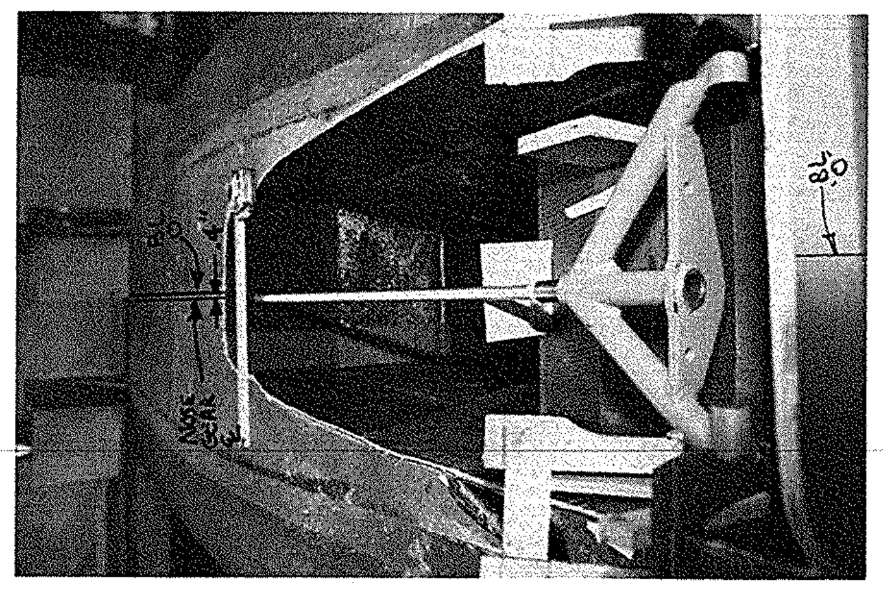
343. Do layup ⑤. (SEE D-36).



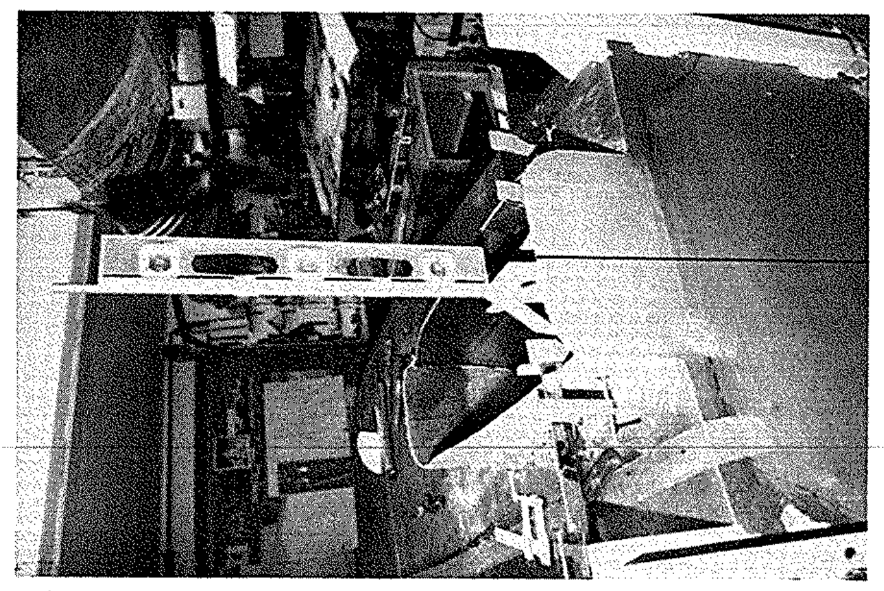
344. Carefully locate and drill pilot hole (1/16") in NGB-1 ears for nose gear retract mechanism. (SEE D-39) Pivot point is W.L. 37 and F.S.64.5.



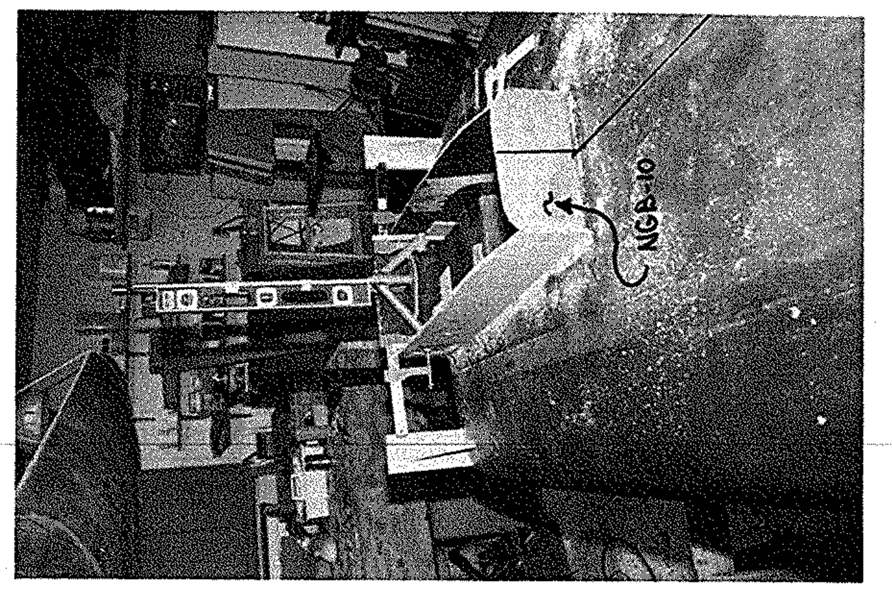
345. Setting up nose gear. Note spacers used to hold nose gear retract portion in place to establish pivot point W.L.25 and F.S.50.5.



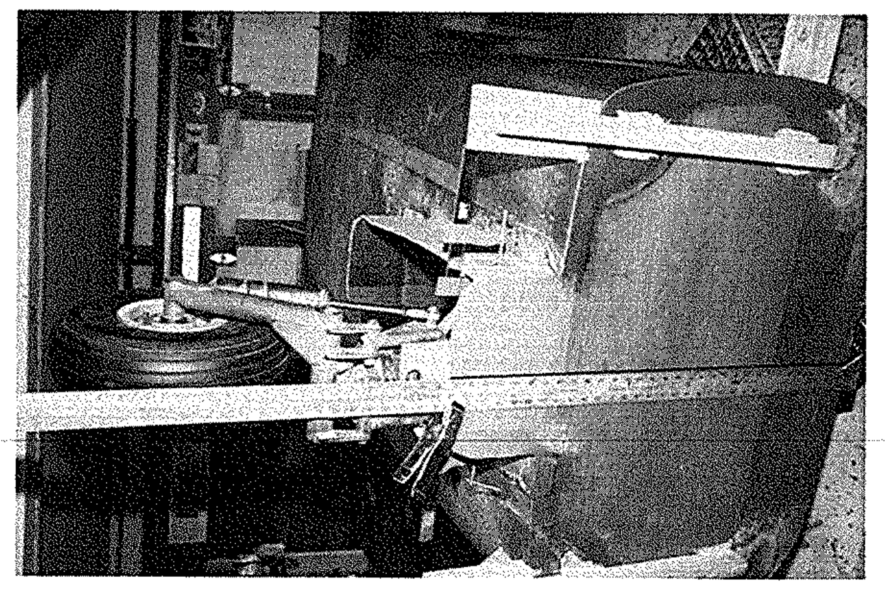
346. Slide 1/2" rod into nose gear pivot and rotate as shown to check and establish all alignments. Take your time and be careful.



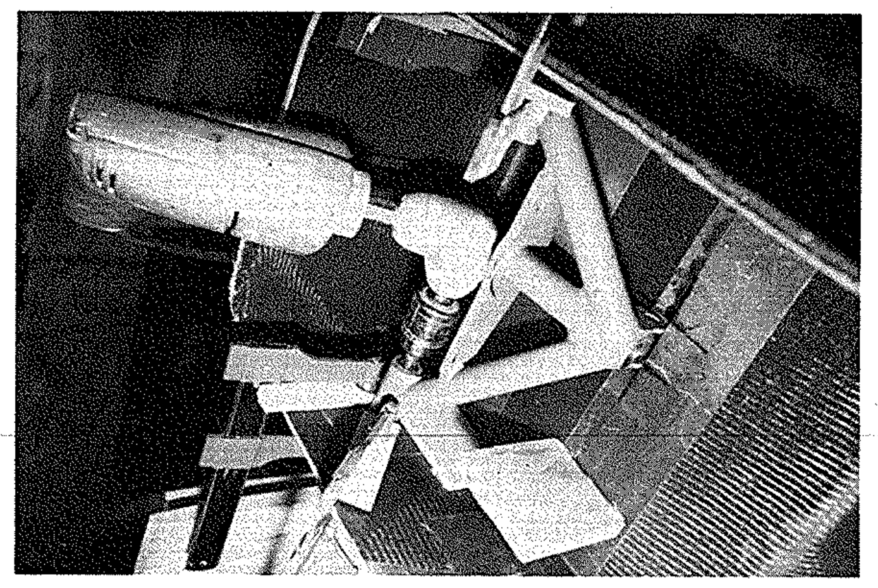
347. Attach carpenters level to rod for added information of alignment. Note fuselage must be leveled because torsional strength of "tub" is weak, carefully level both sides.



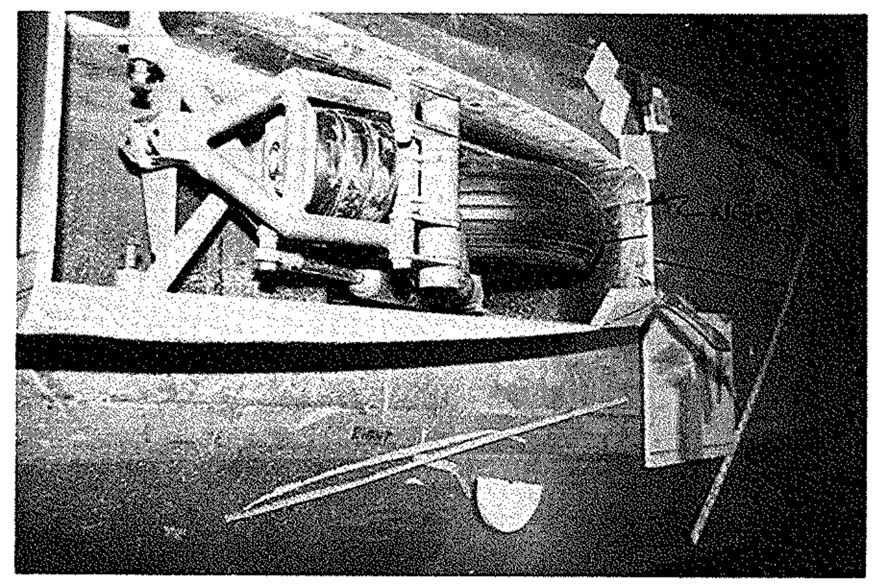
348. Continued alignment checks.



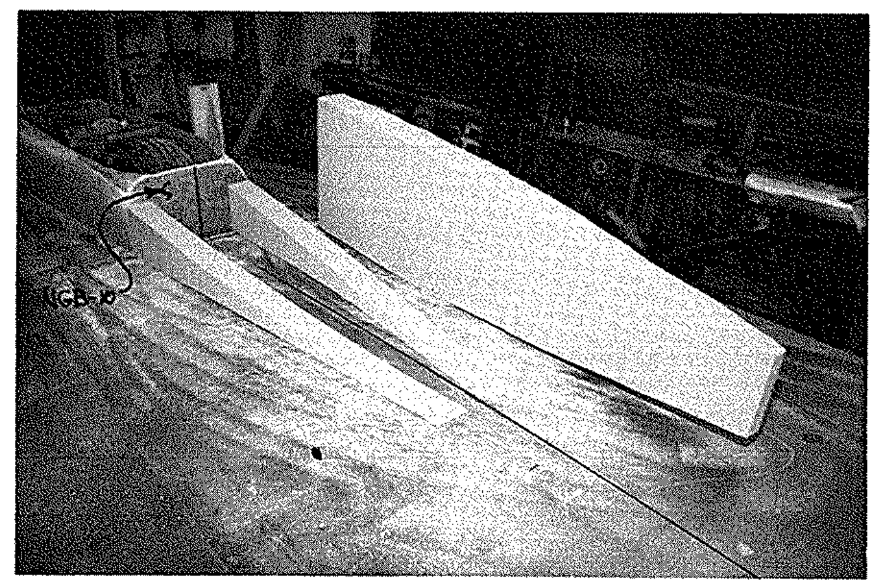
349. Finally attach nose gear strut with wheel to check final positioning.



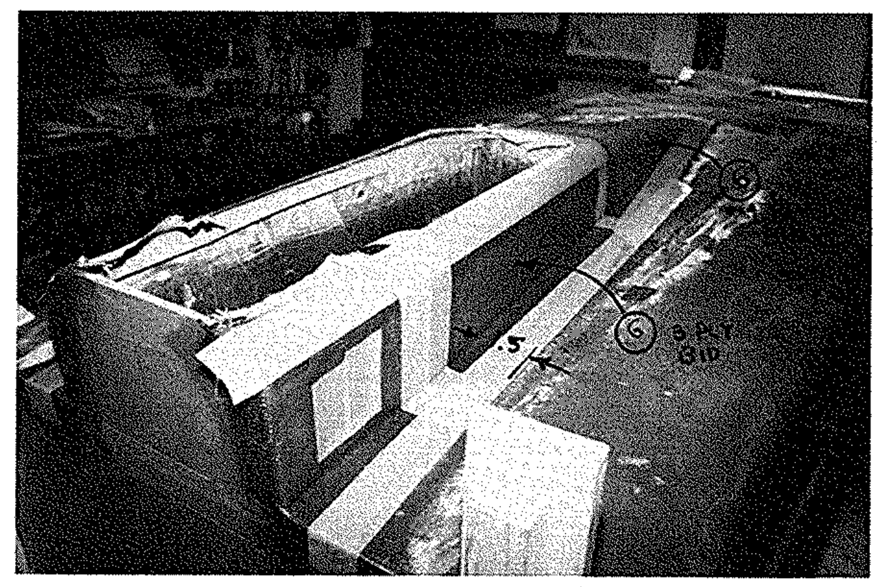
350. Once completely sure of alignment, lock nose gear pivot in place and use to drill 3/8" hole in NGB-2, both sides.



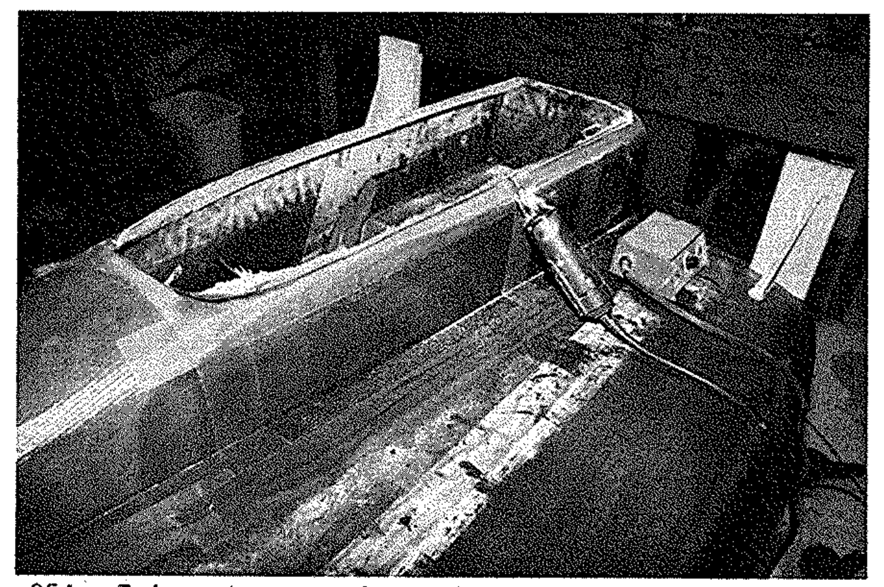
351. Temporarily install nose gear finished form box. Hot glue in foam pieces as required.



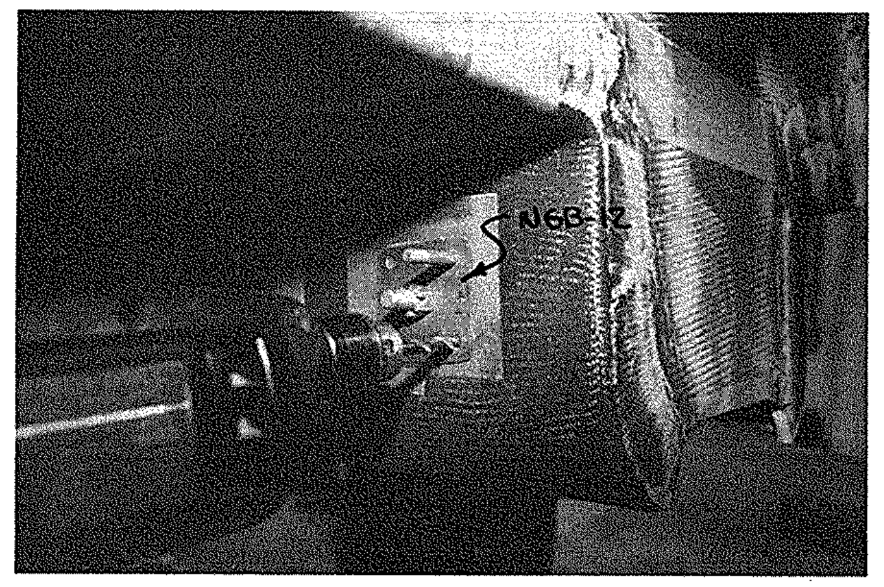
352. Use 2 lb/ft^3 urethane to fair aft end of nose gear box. Micro in place.



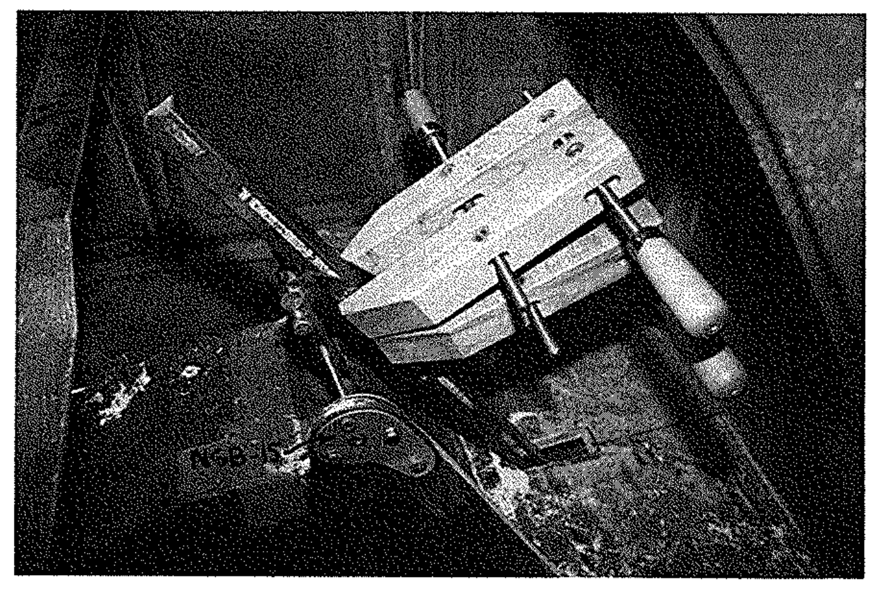
353. Do layup 6 and peel ply all seams. Lap BID on to bottom 1.5" and stagger layers.



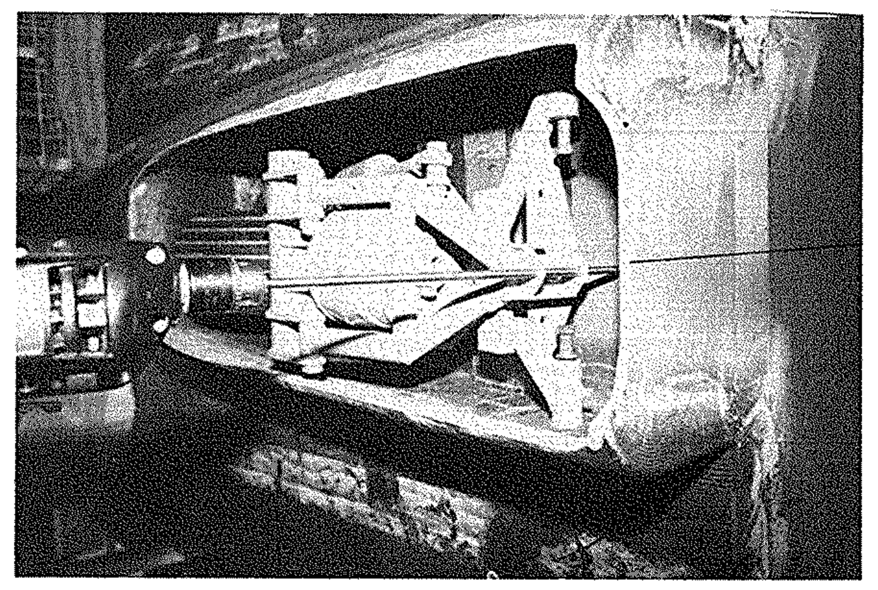
354. Trim edge straight for installation of gear door hinges. Information on gear doors and actuation mechanism will come out later in newsletters. Install .032 2024T3 Aluminum insert and glass 2 plies BID (SEE D-36).



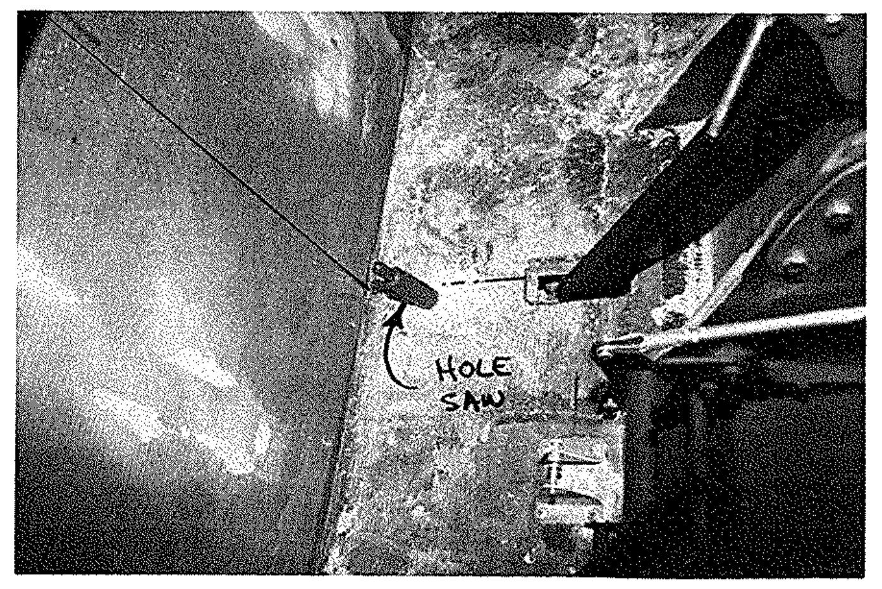
355. Drilling holes for steel plates NGB-11 and NGB-12. Note pivot hole is enlarged to fit NGB-17 (SEE Section B-B D-36).



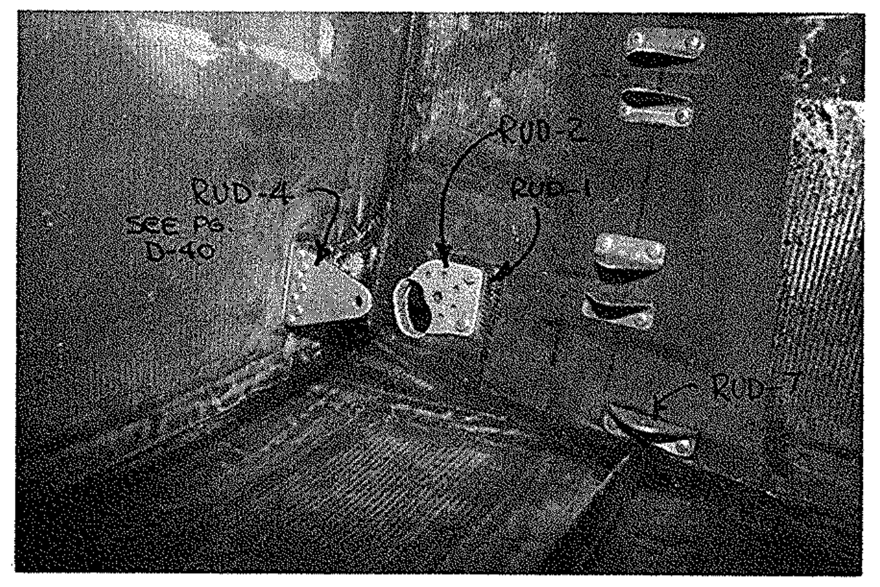
356. Constructing nose gear retract arm NG-1. (SEE D-39 and D-40).



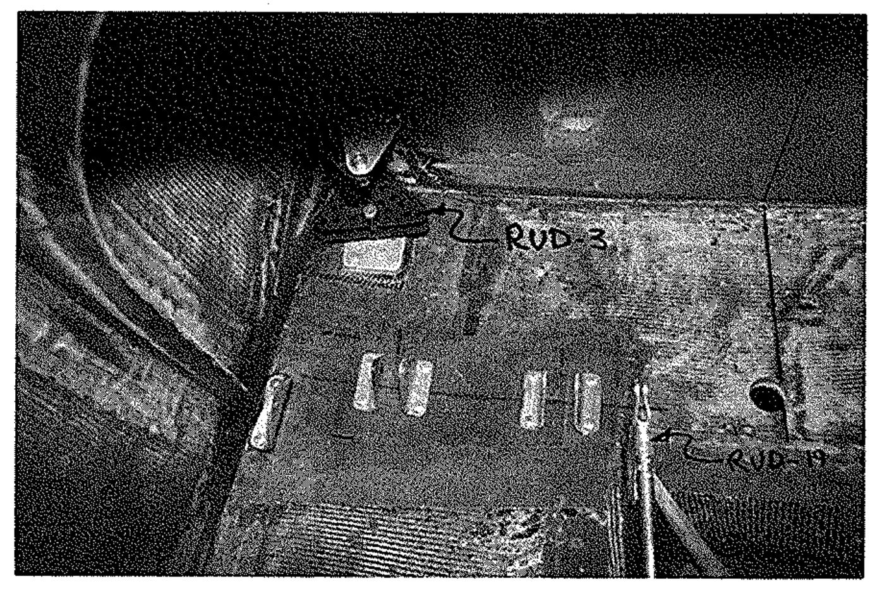
357. With nose gear installed drill with long 1/4" bit through NGB-5 in floor of "tub" using nose gear as guide.



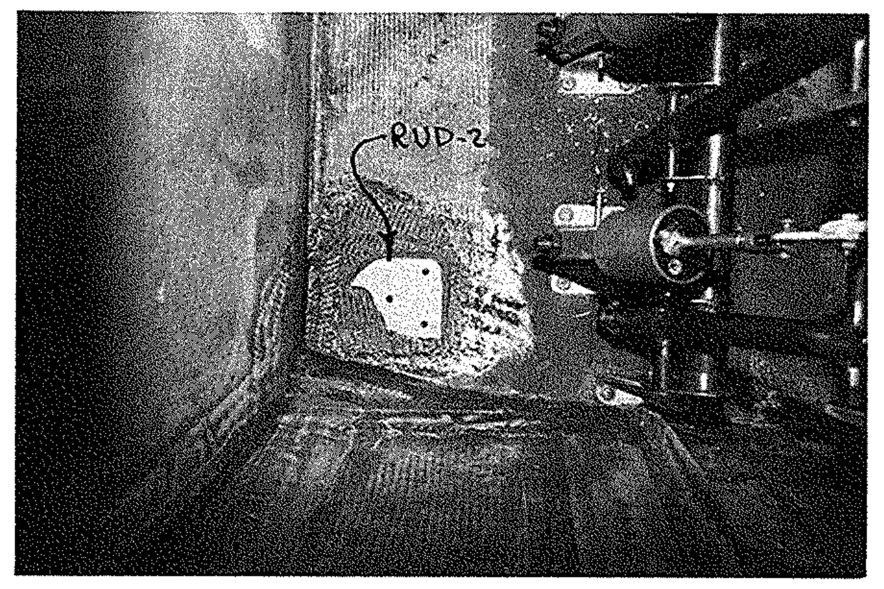
358. Attach "Real McCoy" (brand name) hole saw to bit, reverse drill rotation and pull saw thus, cutting 7/8" hole for NG-12. NG-12 can be floxed and bolted in place.



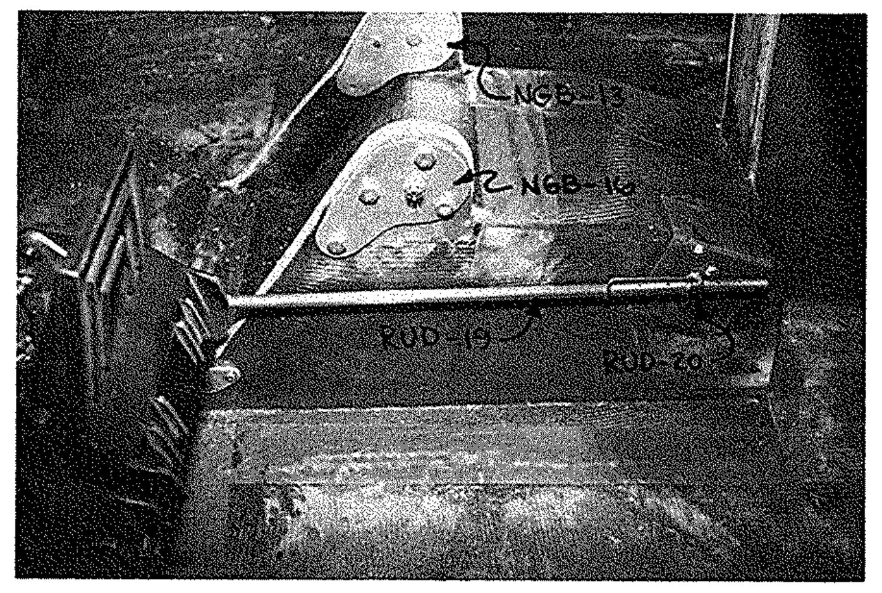
359. Installing pedal and rudder parts.



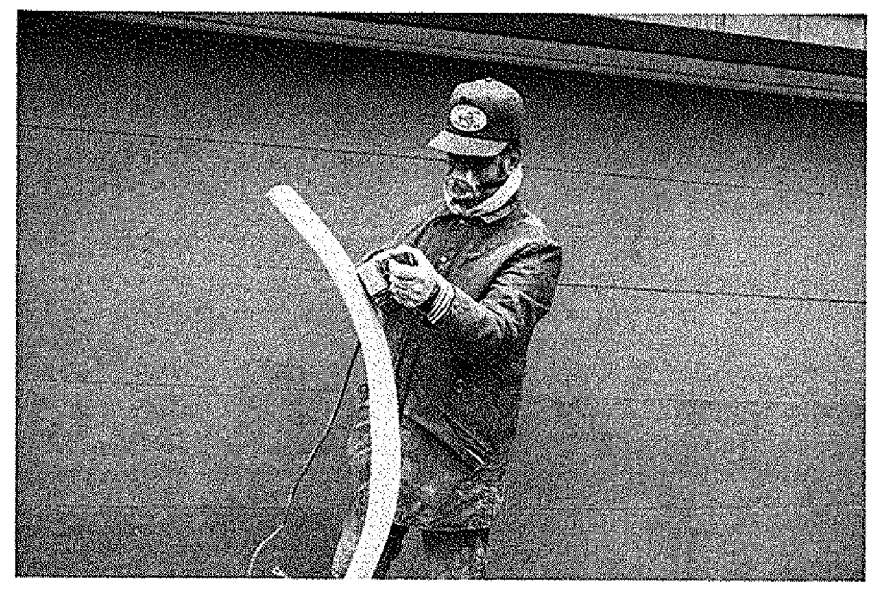
360. Showing RUD-3 which is belcrank to move rudders and to steer nose gear.



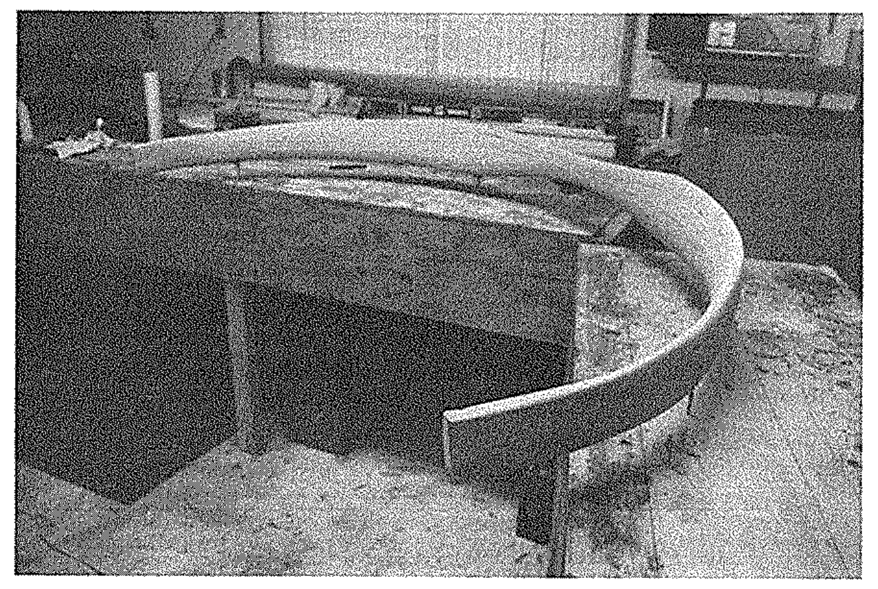
361. RUD-2 and details of brake master cylinder placement.



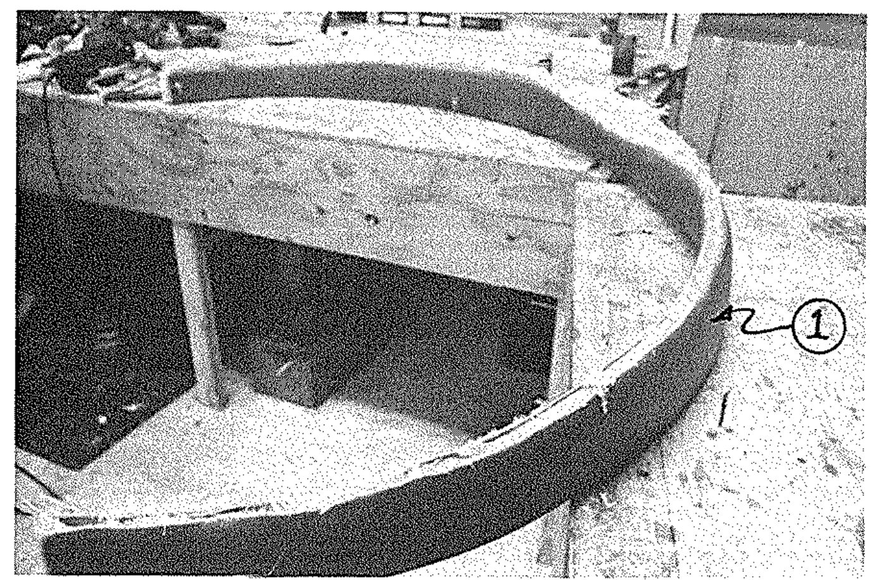
362. Nose gear box and pedals.



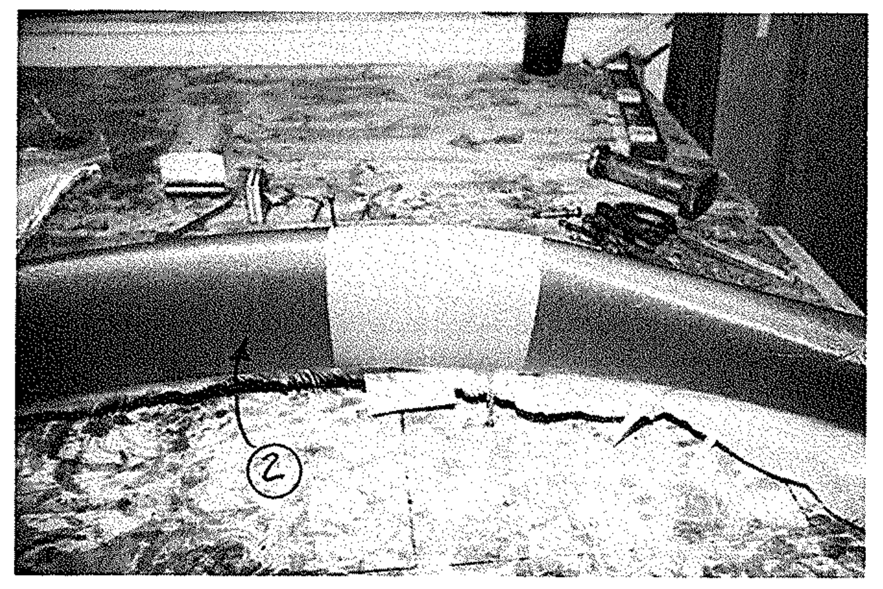
363. Main Gear Strut. Sand entire surface of main gear strut before doing torsional layups. SEE D-37.



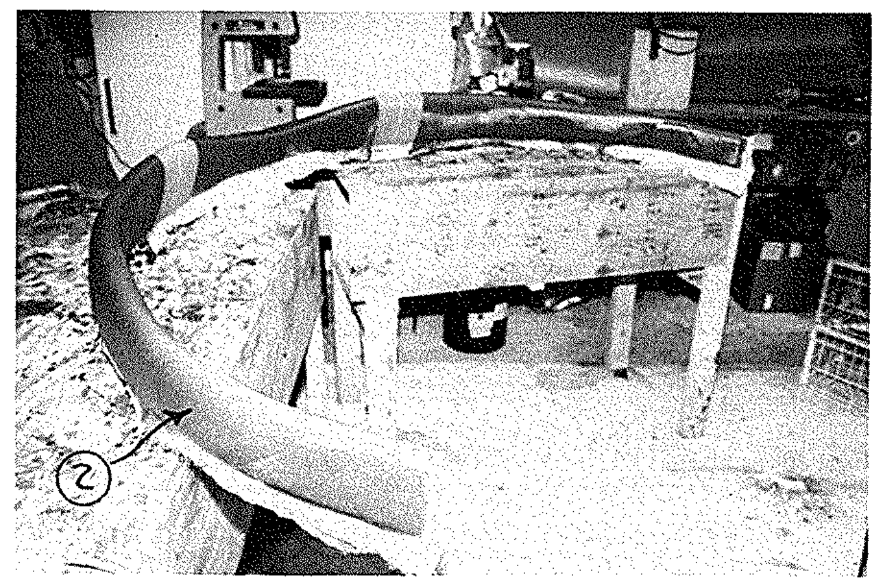
364. Bondo sanded gear strut (trailing edge up) to nails in work table.



365. Apply layup ① to trailing edge. After cure trim rough edges and turn gear over and reattach to nails.

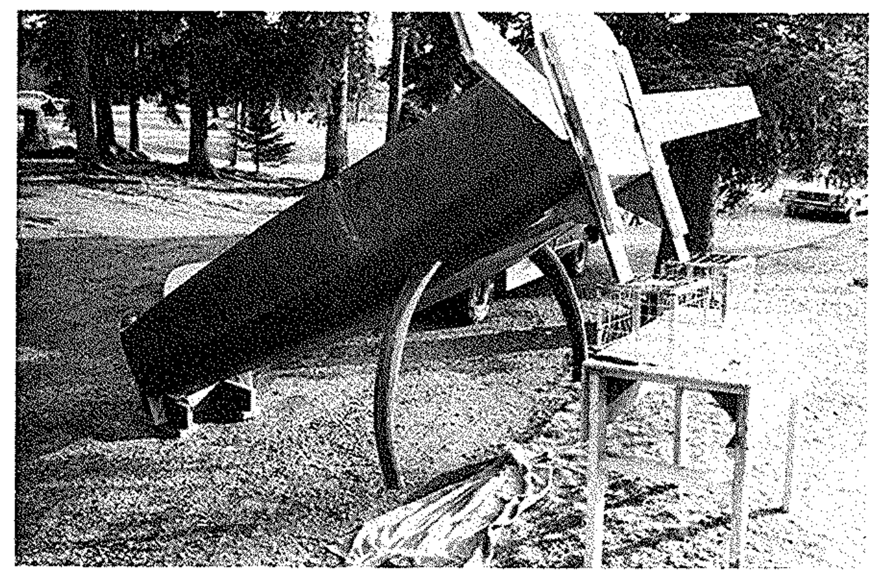


366. With leading edge up to layup ② and peel ply attach points.

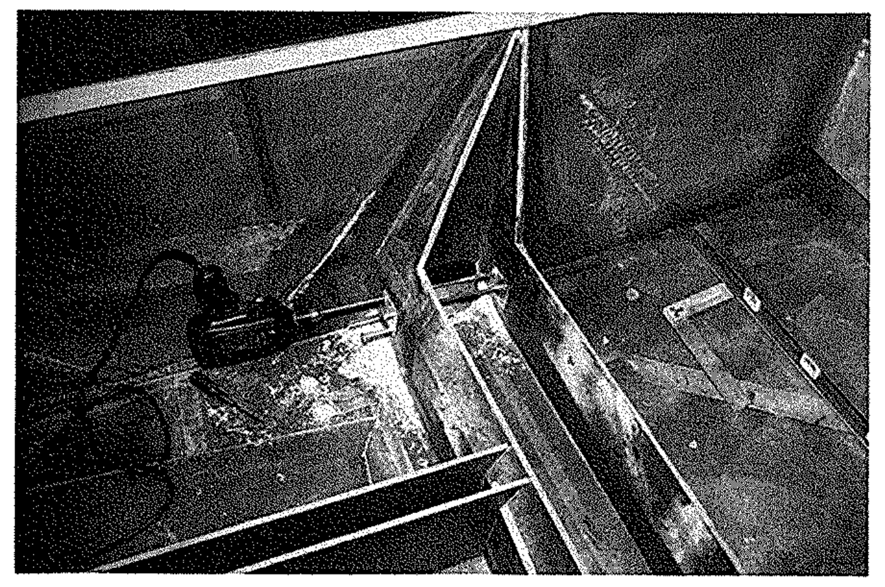


367. After layup ② is cured, trim landing gear smooth.

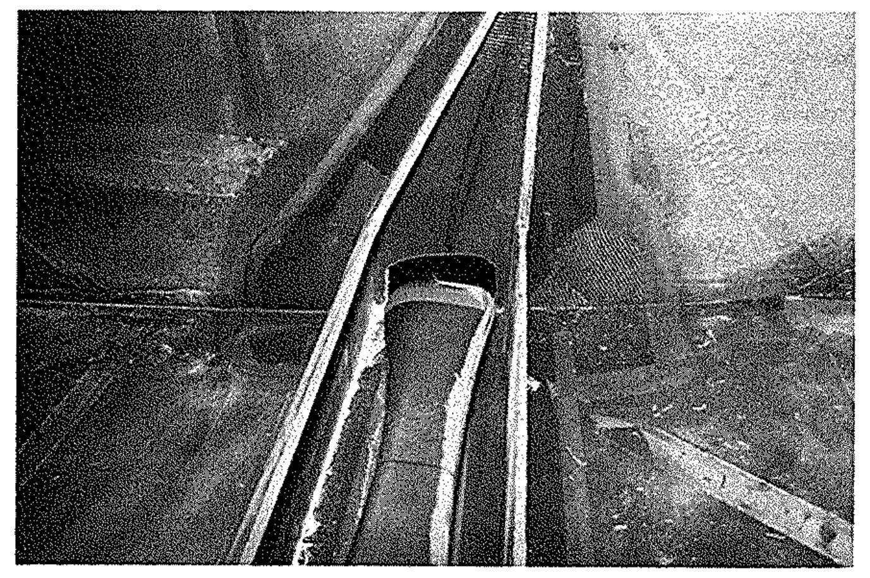
368. Study drawing D-37 and cut holes for gear legs.



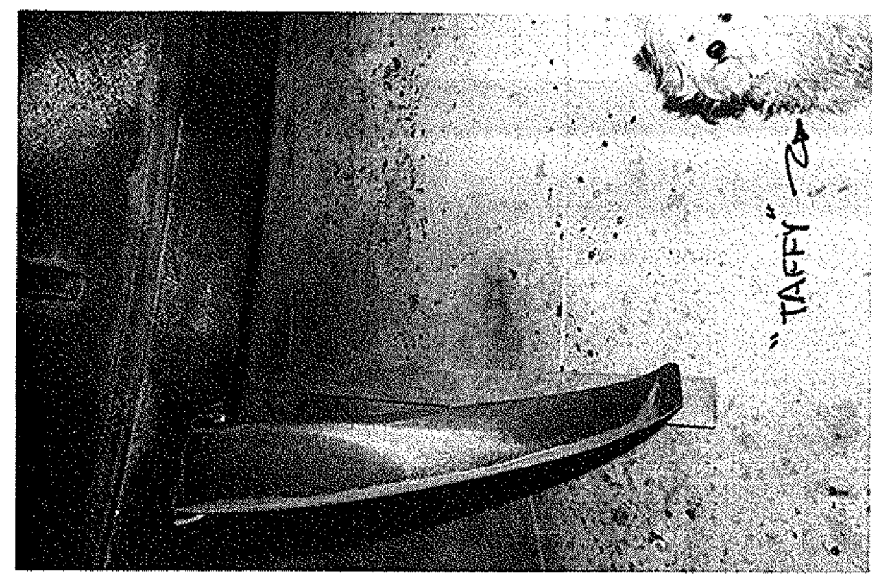
369. Installing main gear for FIRST time.



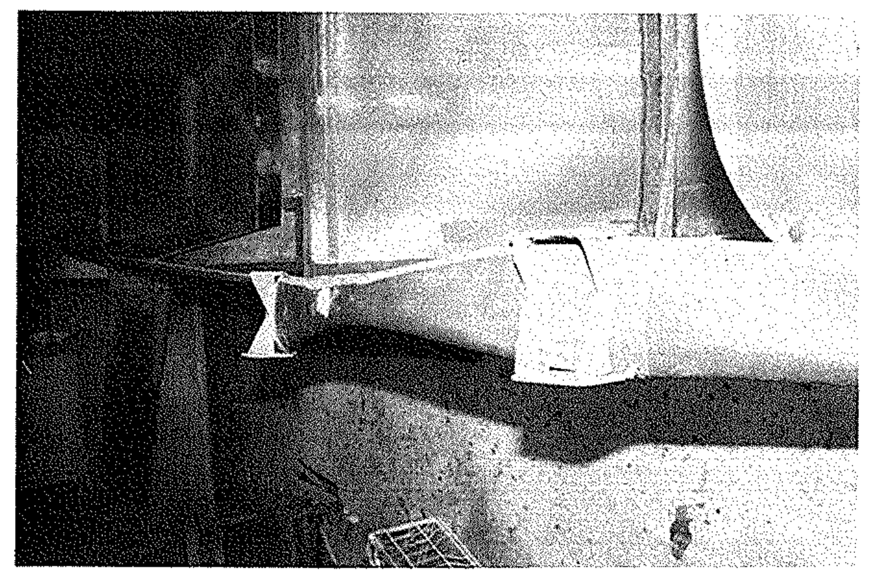
370. Clean out holes in main gear bulkheads after being covered by reinforcement layup in fuselage.



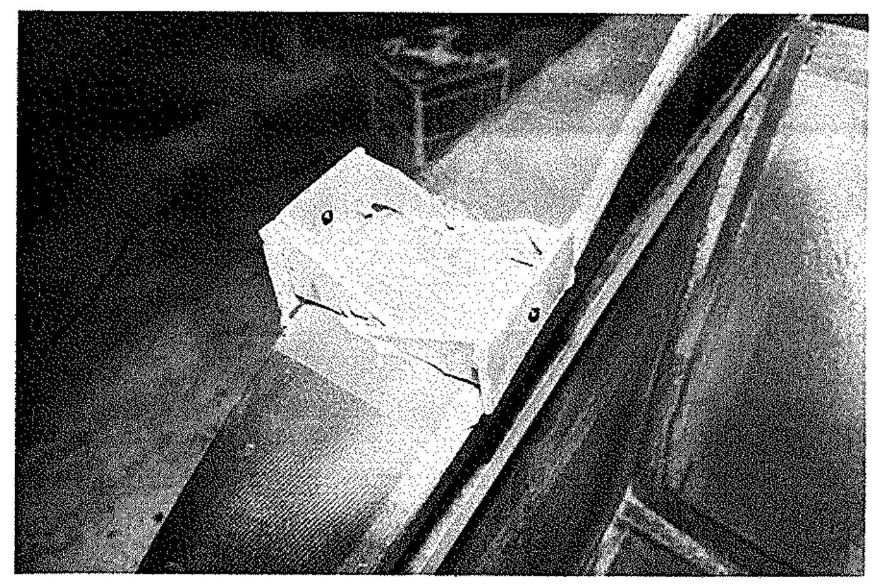
371. Right side of fuselage has a larger hole cut in it to allow for gear tabs going in and out of 'tub" while constructing.



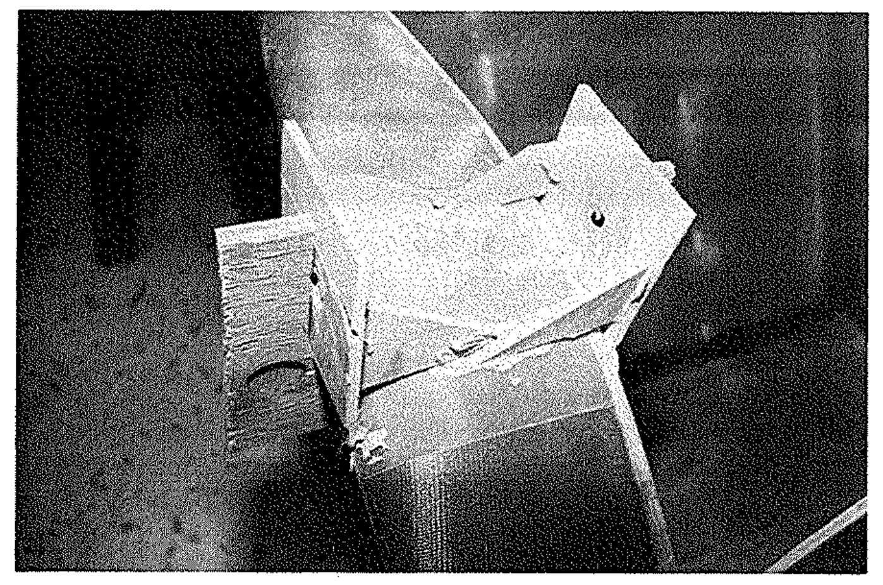
372. Using details on D-37 and careful preparation, align main gear strut.



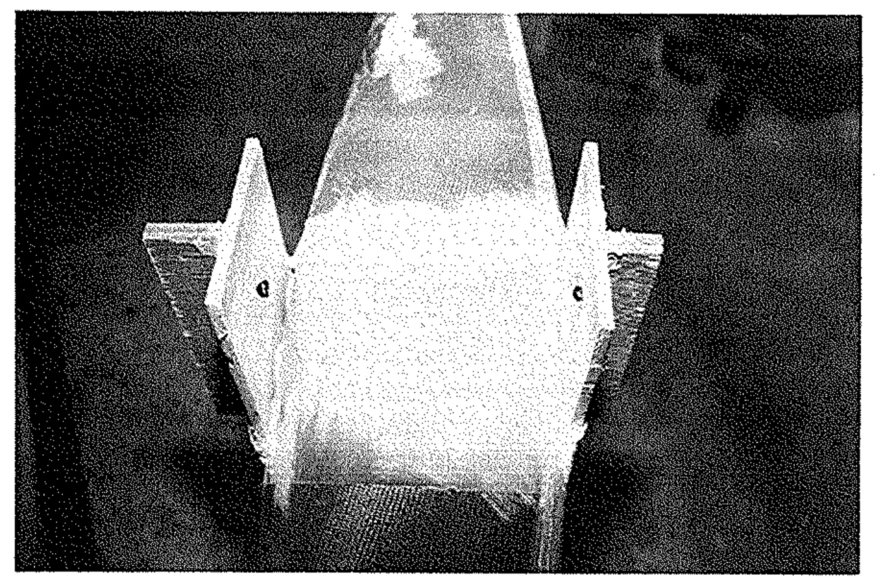
373. Once strut is aligned and in proper position, attach wood blocks as shown on D-37.



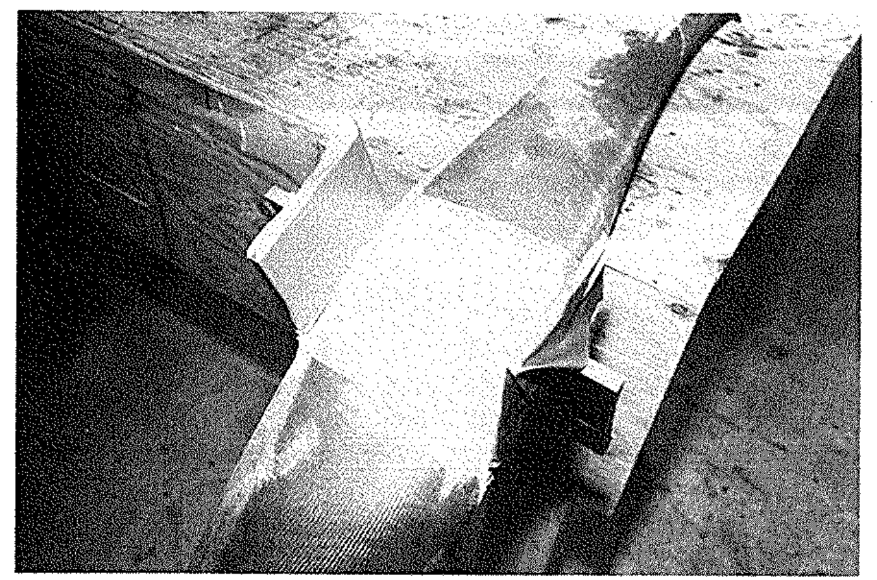
374. Suspend wood blocks on 1/4" steel rod install in main gear bulkheads. After everything is aligned, bondo blocks to gear strut. Add gussets as shown.



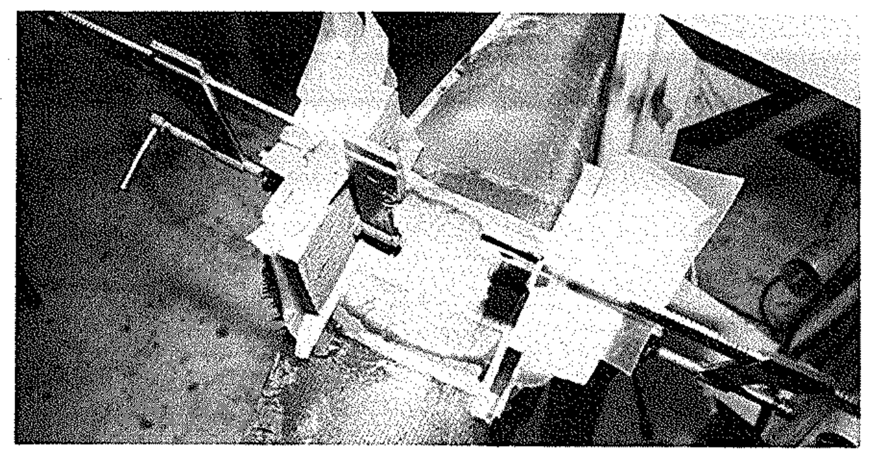
375. Remove gear from "tub" and install outside support. Bondo in place.



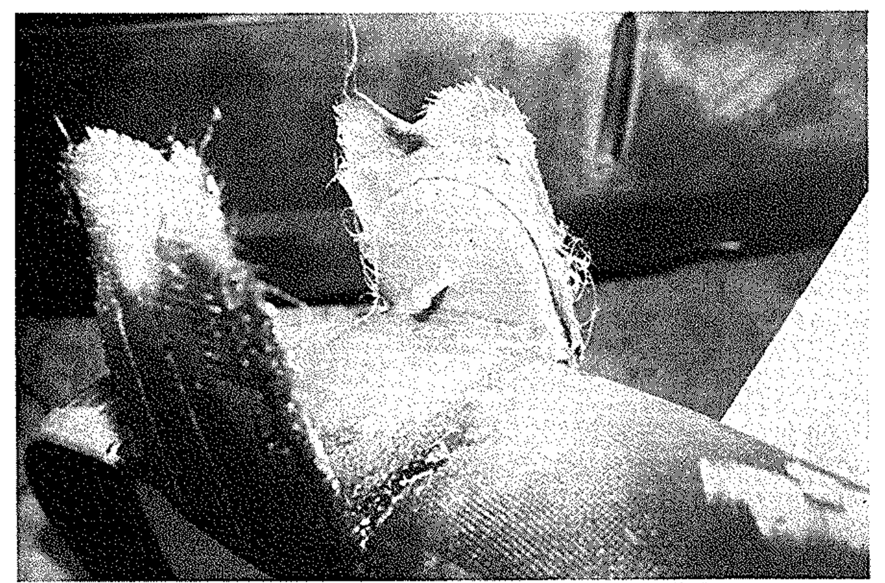
376. Remove inside gussets and sand surface dull (36 grit).



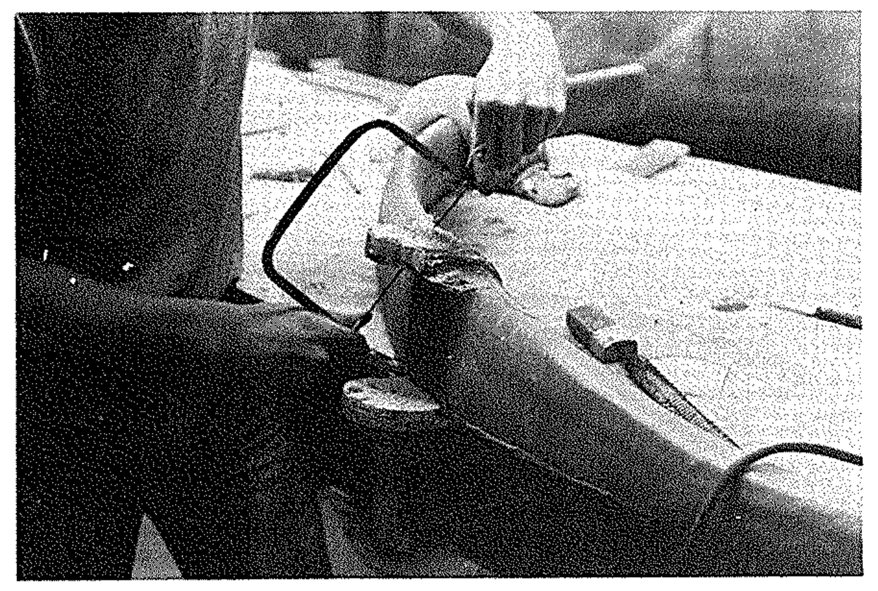
377. Apply grey duct tape to wood blocks for release. Cover inside face of wood block with peel ply over the grey tape.



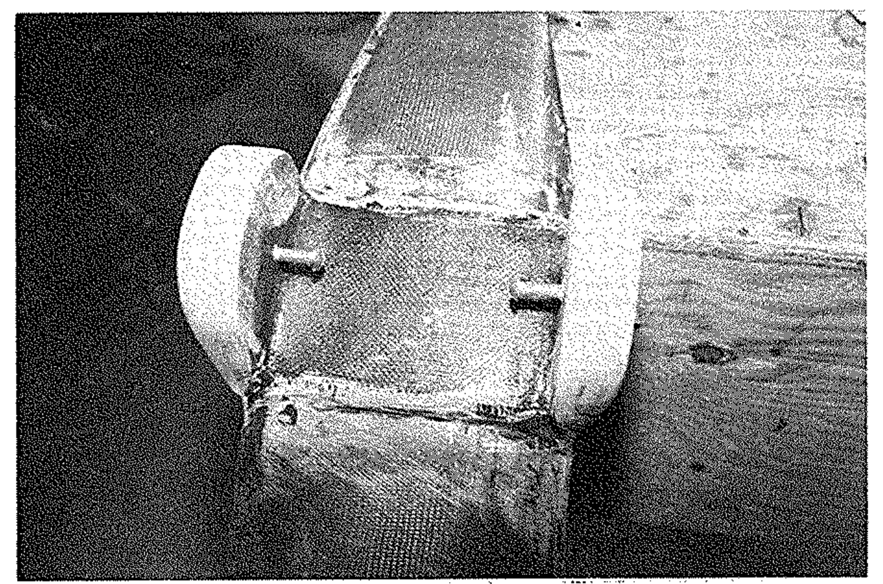
378. Do layups ①, ② and ③ and lightly clamp as shown.



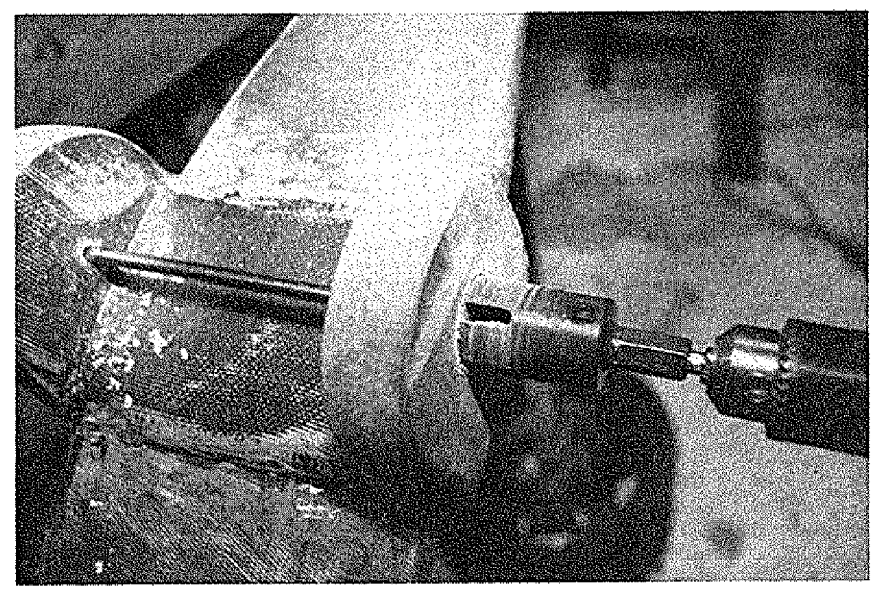
379. Main Gear. Layups ④, ⑤ and ⑥ after cure.



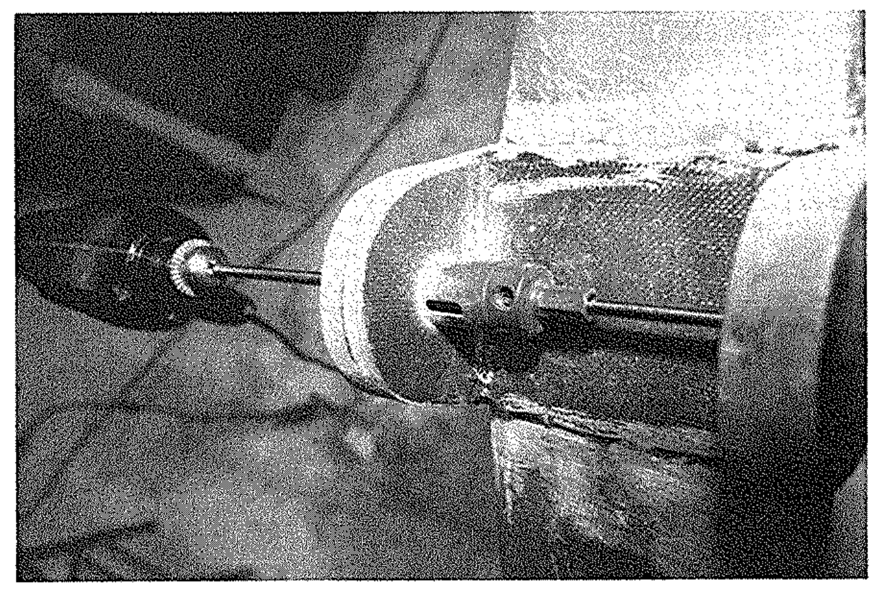
380. Shape attach tabs as shown.



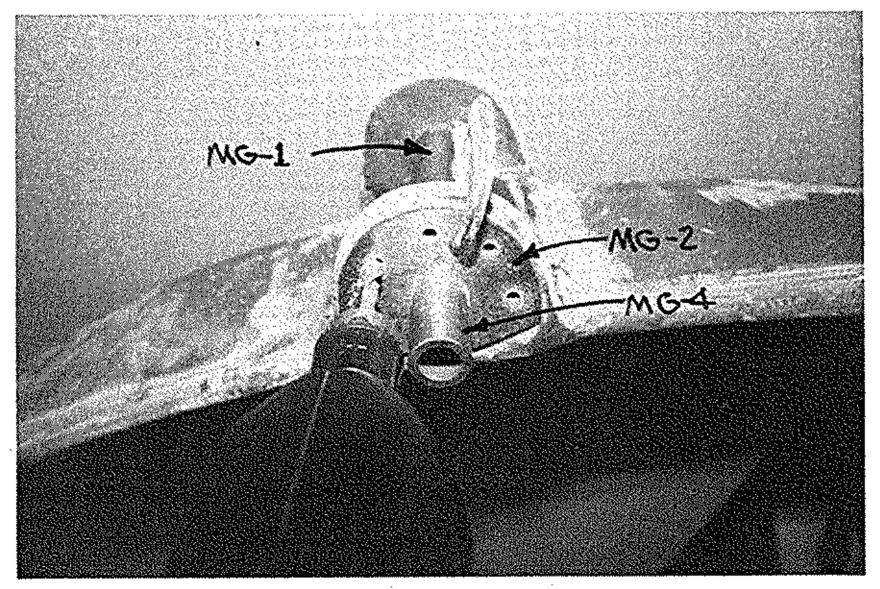
381. Attach tabs after shaping. Note each tab is 100 layers of glass. Use screws to identify 1/4" holes as transferred from temporary wood blocks. (SEE D-37).



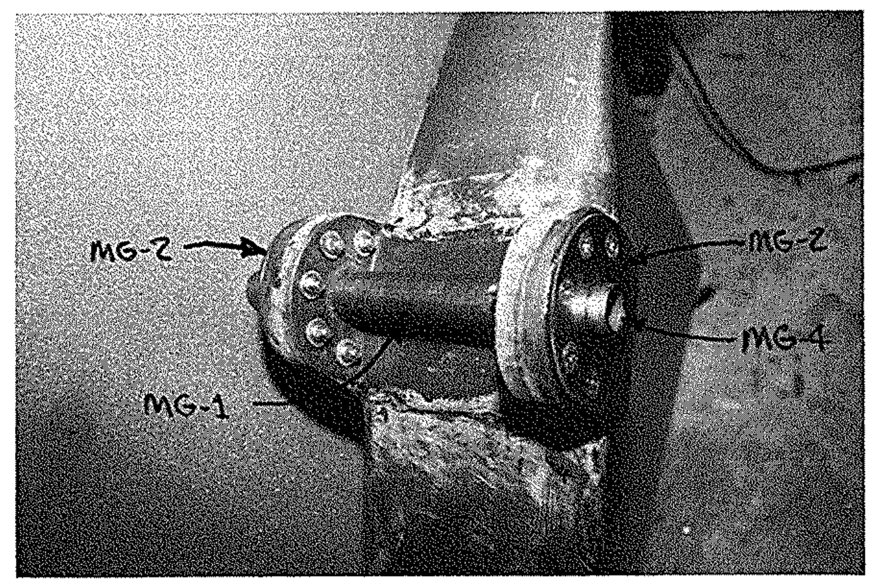
382. After drilling 1/4" holes through each tab, cut out required 1 1/8" hole with (Real McCoy) hole saw on 1/4" rod.



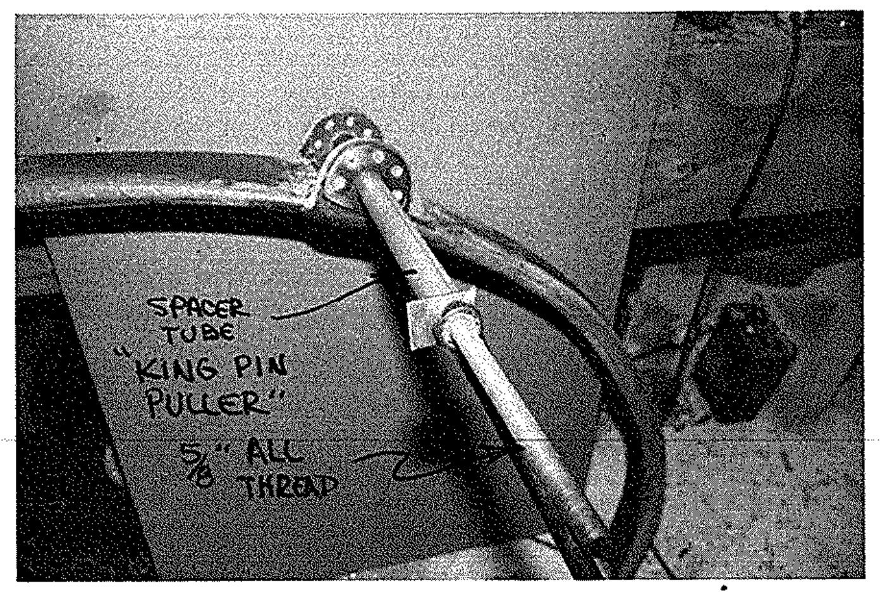
383. Hole saw can be pushed or pulled through work. In this photo I have reversed drill rotation and using drill to pull saw into tab.



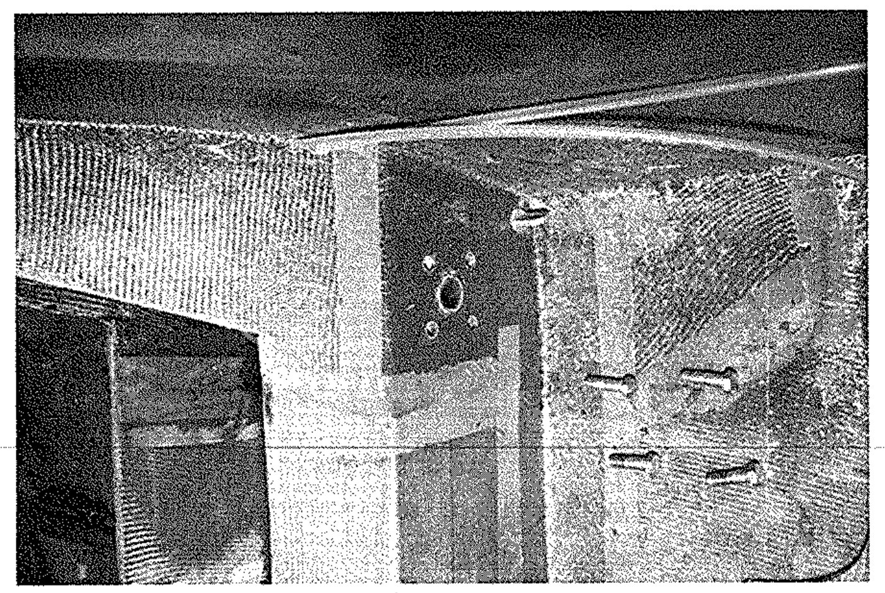
384. Install (flox in place) MG-1 into tabs (2 locations) using MG-4 "King Pin" pushed into MG-1, slide MG-2 over MG-4 (pin), clamp and drill for AN-509-416R24 Bolts. (5 places each side).



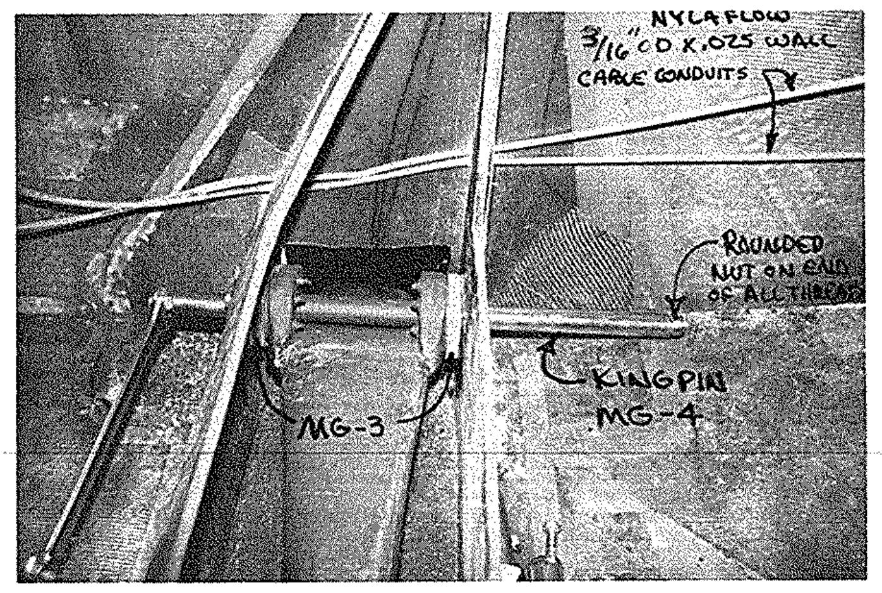
385. Completed unit. Spray bare steel with ZINC chromate primer to protect against rust.



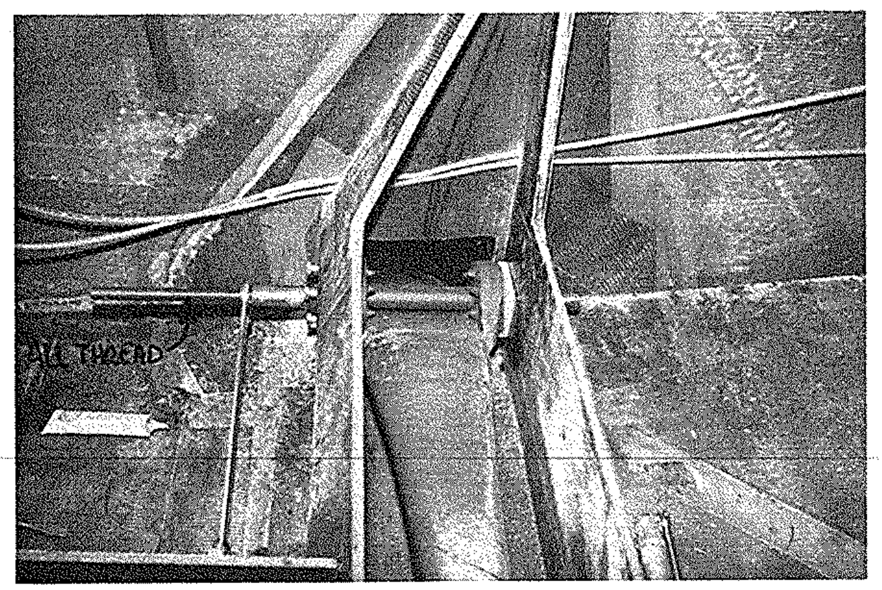
386. Make King Pin (MG-4) puller - 5/8" all thread with rounded nut. (Diameter less than king pin) and spacer tube.



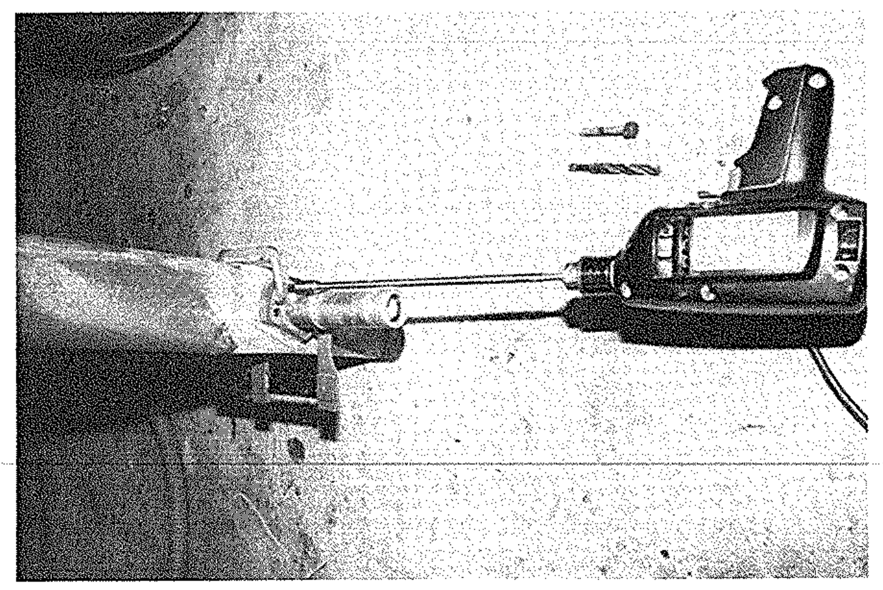
387. With (Real McCoy) hole saw, cut center 1/4" hole to 1 1/8" and install MG-6 bushing.


NYLAFLOW 3/16" OD X .025 WALL CABLE CONDUITS
ROUNDED NUT ON END OF ALL THREAD
KINGPIN MG-4
MG-3

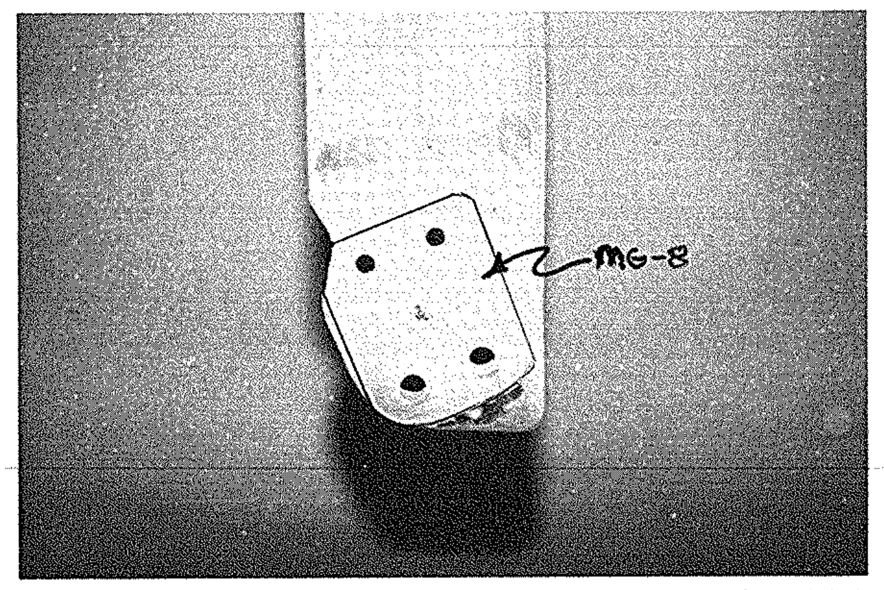
388. Install gear into fuselage and using puller, install MG-4 into attach point. NOTE: NYLAFLOW (3/16 x .025) is used as aileron cable conduit.



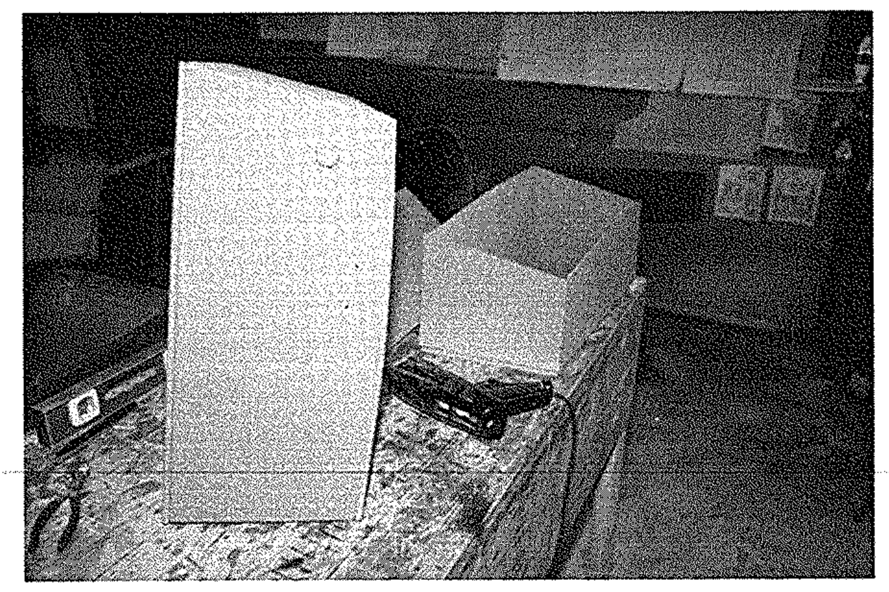
389. MG-4 is almost in place. Lube pin with grease. Straighten and align aileron cable conduit (NYLAFLOW) and temporarily attach with hot glue. Cover with ① PLY BID 2" wide tape.



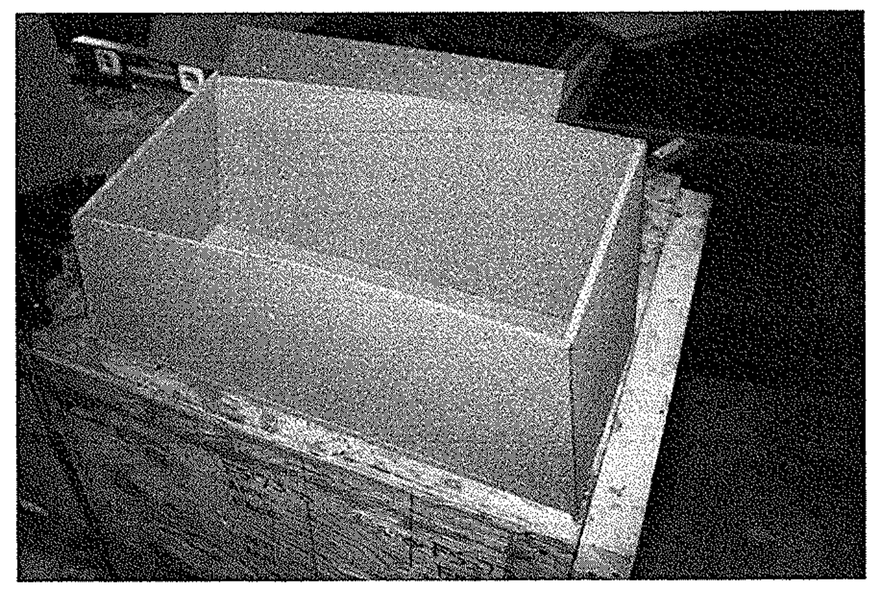
390. Place required BID wedge layup to camber axle 10° down and with .2 to .45" toe in. (SEE D-37). Drill for axle attach bolts.



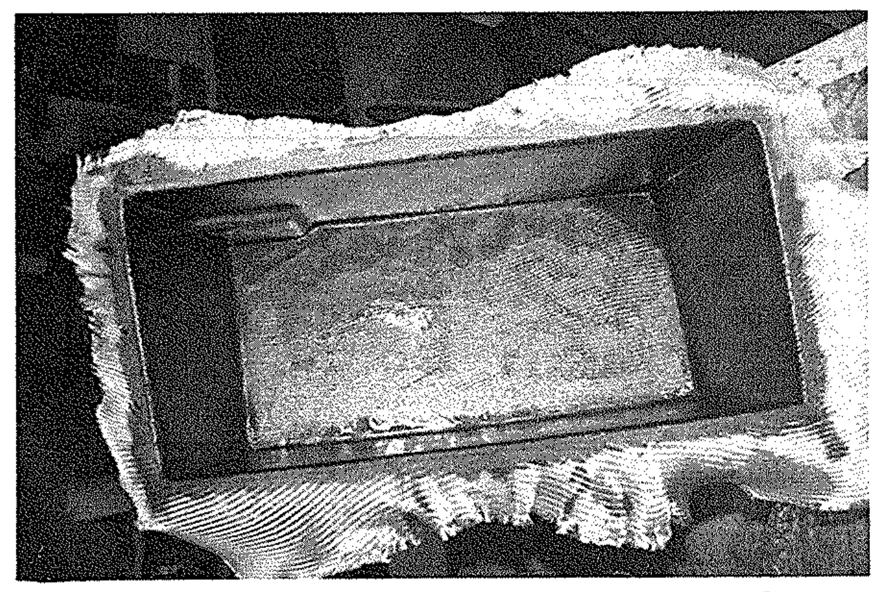
391. Right gear leg at axle end. Note angle which axle is attached and shape of gear strut.



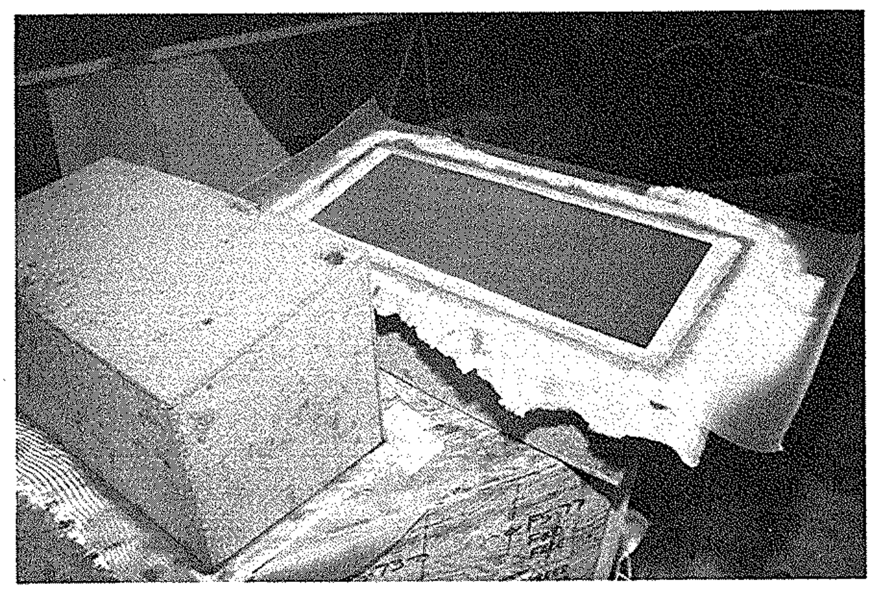
392. Fuel sump tanks. (SEE D-38). Hot glueing 1/4" R45 foam tank pieces together.



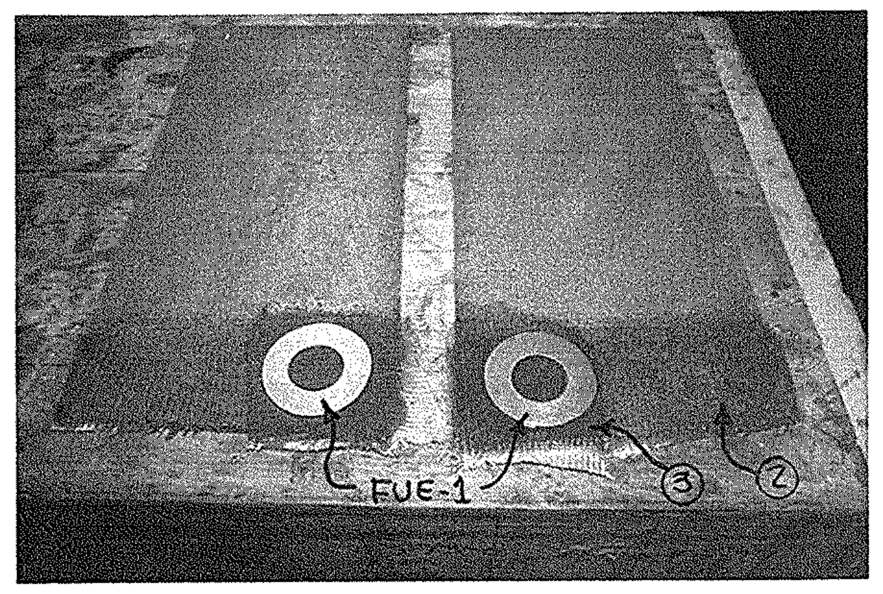
393. Fuel sump tank.



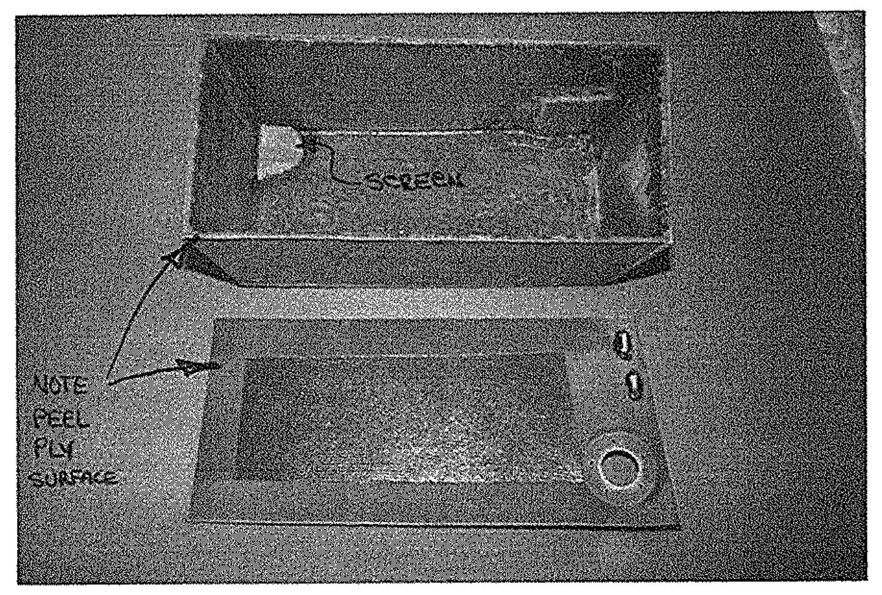
394. Inside of sump tank (no lid) showing BID layup. 2" wide BID tape not in place yet. Note how "wet" layup is. This will protect against leaks.



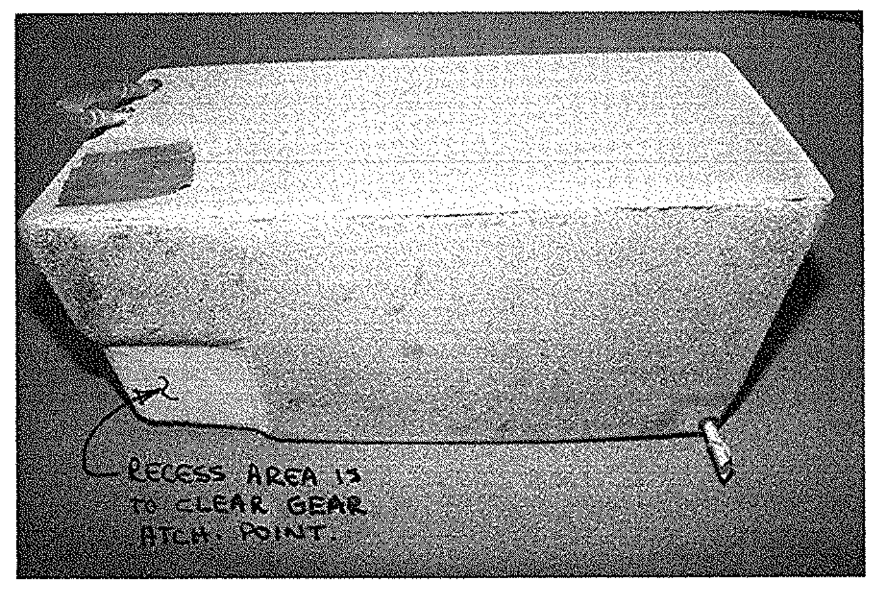
395. After inside layup is complete. (SEE D-38). Peel ply edges, allow to tach for 3 hours and turn top opening down on flat table.



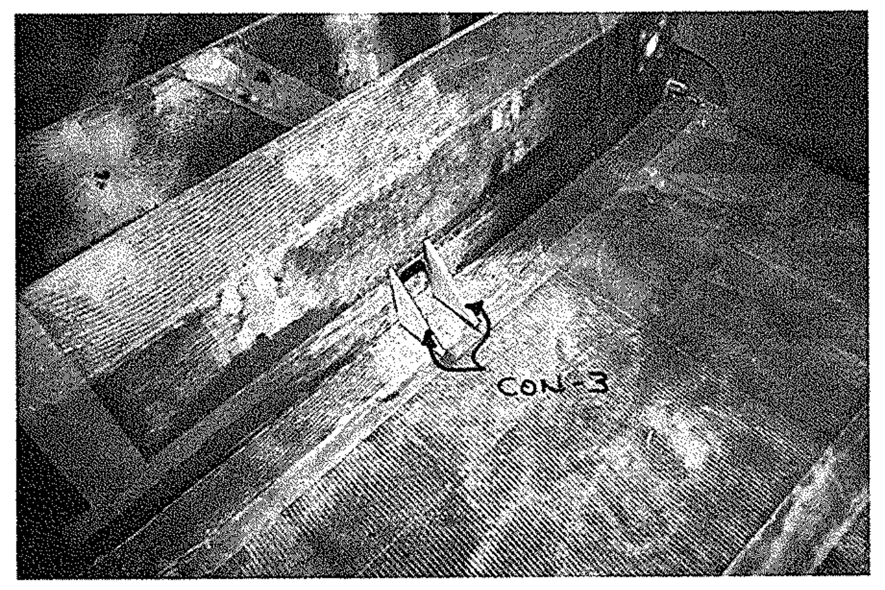
396. Inside each sump tank lid just before layup 4 .



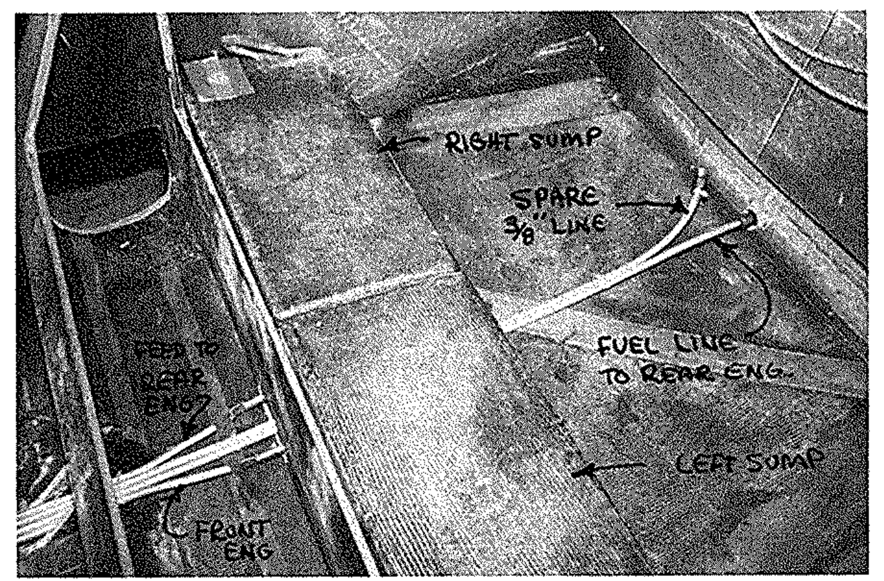
397. Sump tank is ready for lid placement. Place .3 high ridge of wet flox around lip of bottom section and wet lid border with epoxy. Place lid on tank, turn upside down and weight bottom section.



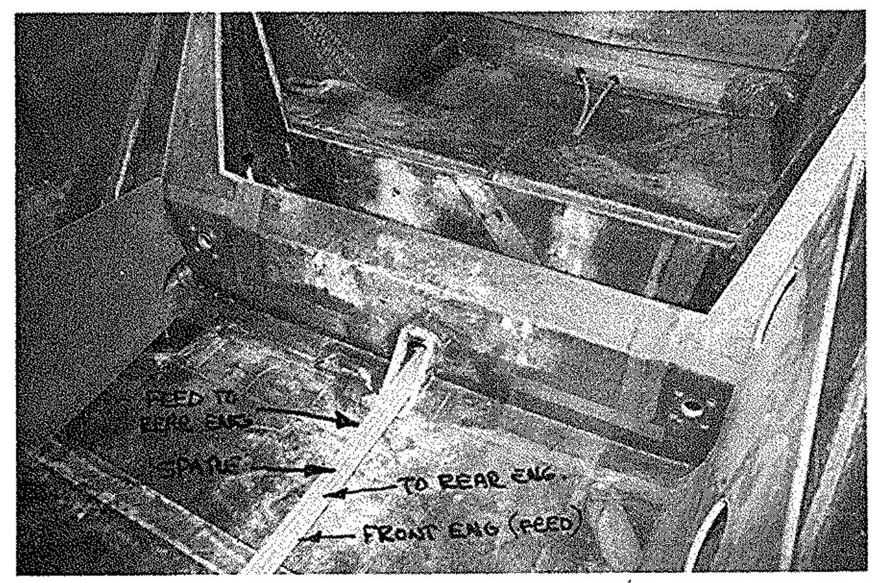
398. After lid is cured to bottom section, shape edges and recess area as shown and do layup ⑤ and (5A) .



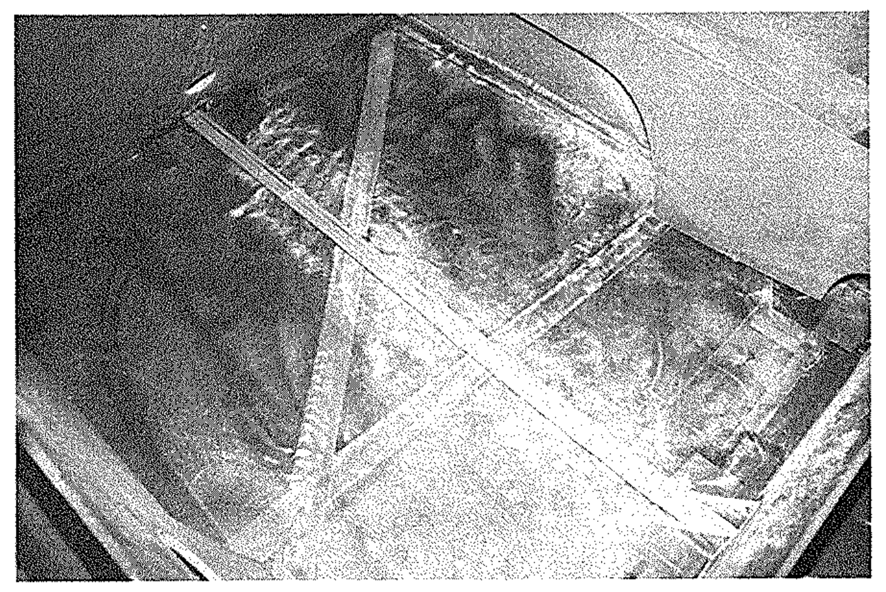
399. Placing con-3 (seat belt attach point). (SEE D-46)



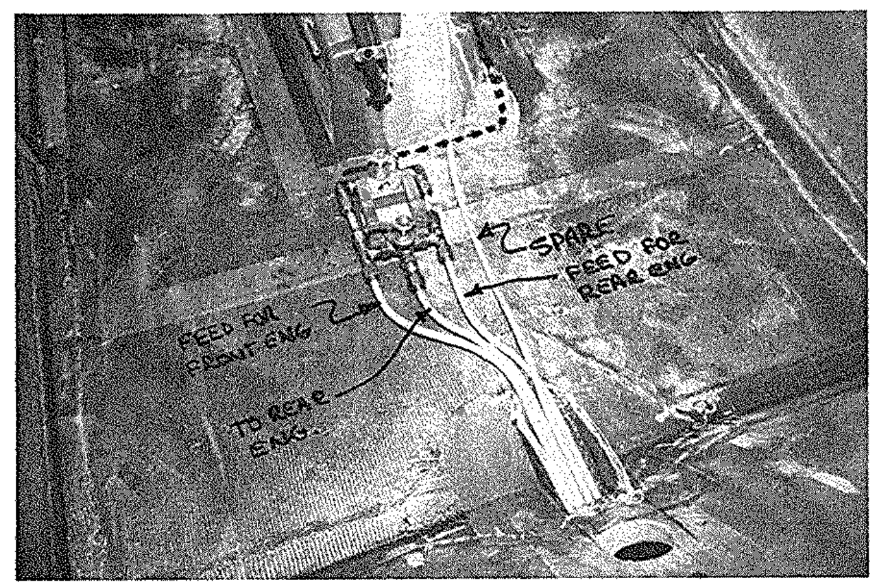
400. Sump tanks in place. Tanks are held in place in aircraft by 7 blobs of silicone (RTV). 5 blobs on bottom of each tank and 2 blobs on FORWARD face each tank. Tanks connect to fuel lines with 1/2 O.D. x 3/8 I.D. polyurethane tubing and #6504 hose clamps.



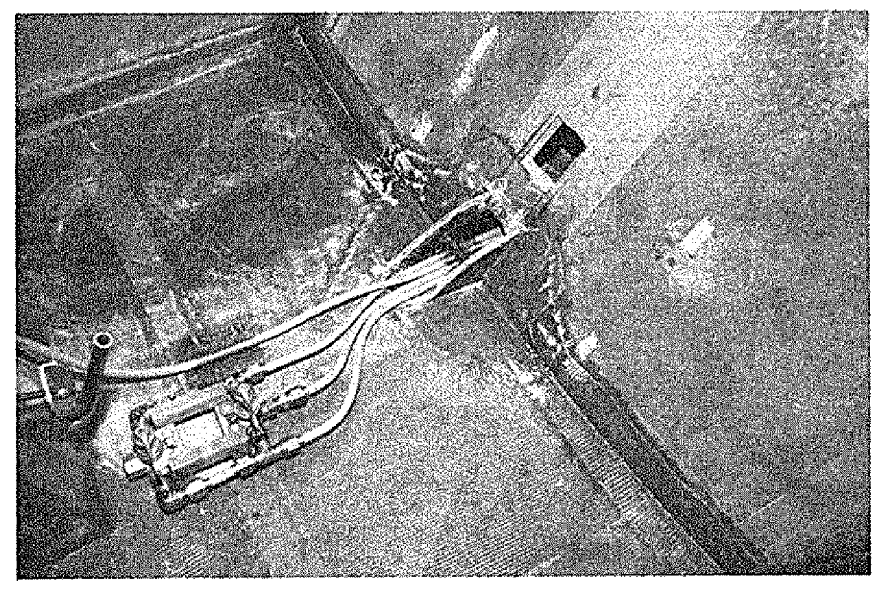
401. Group fuel lines as shown. Silicone to the floor.



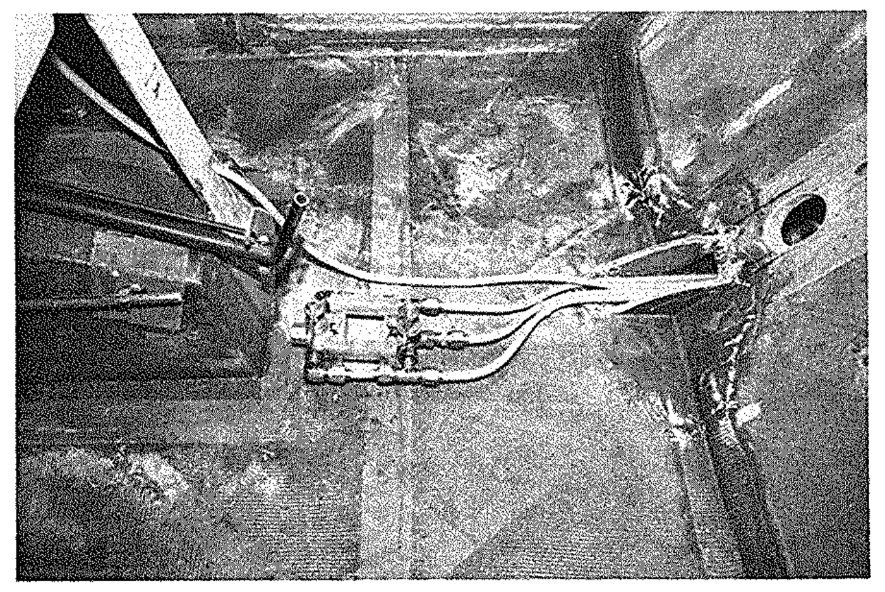
402. Fuel lines run through rear seat area. Spare 3/8" line can be used for rear vacuum source or just in case a problem develops with other lines.



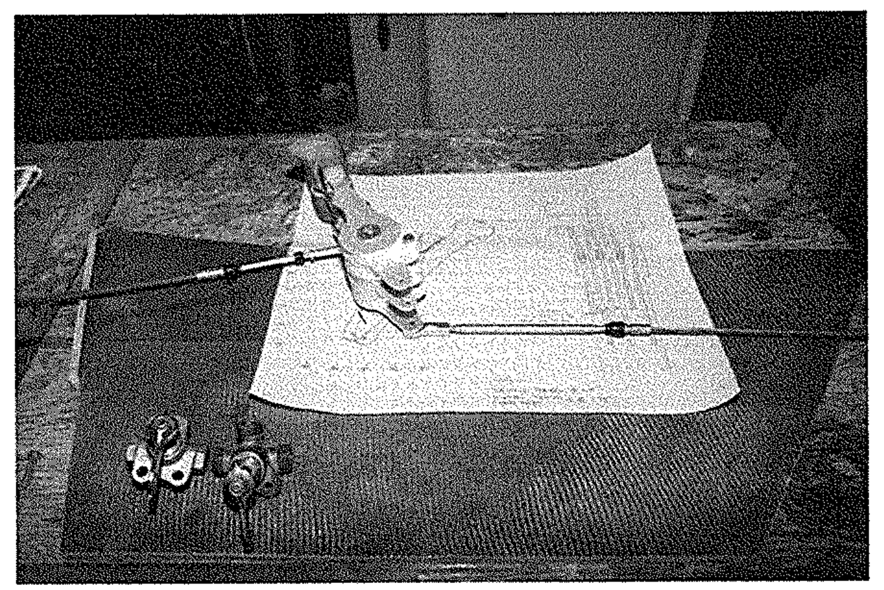
403. Layout of fuel valve. Note dotted line indicates path of fuel line to front engine. (SEE D-38)



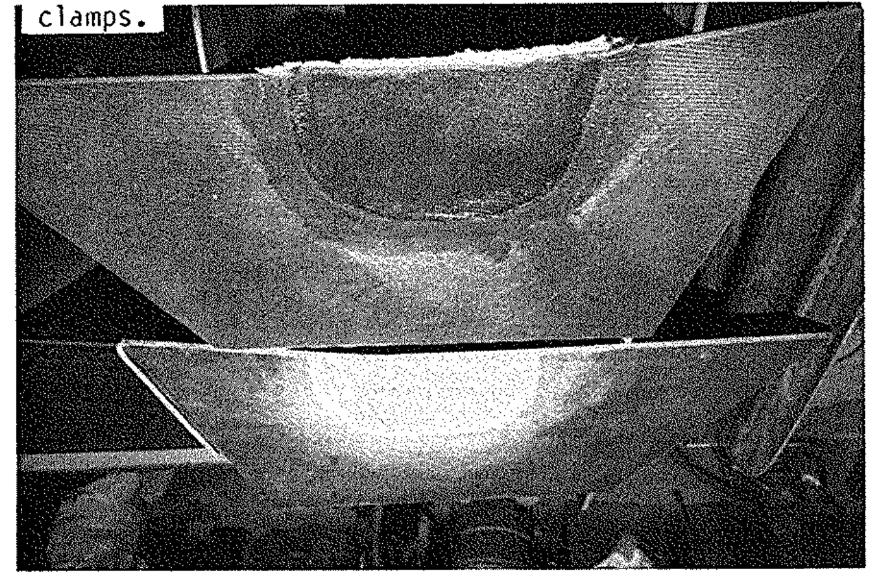
404. Fuel valves - study fuel selector valve cover for operation. (SEE D-38).



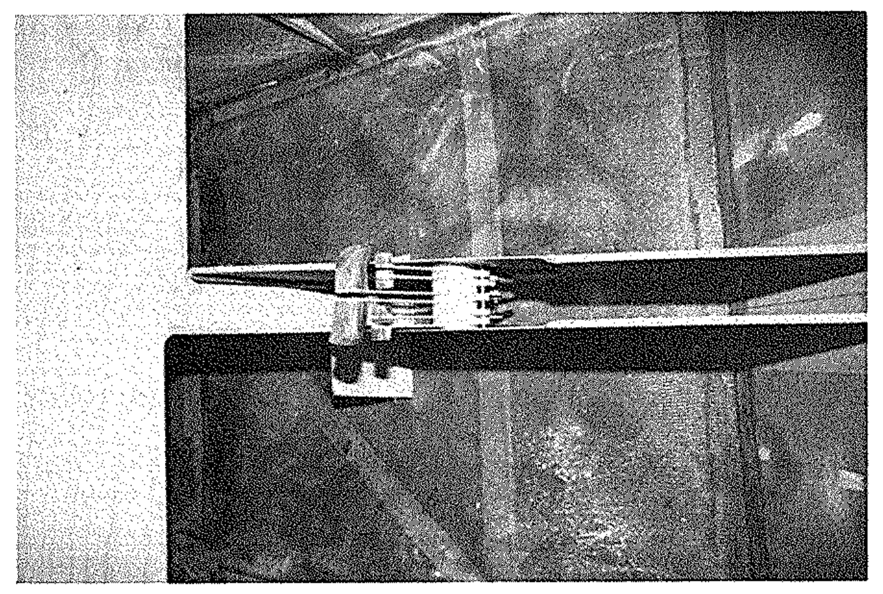
405. FUEL VALVE arrangement.



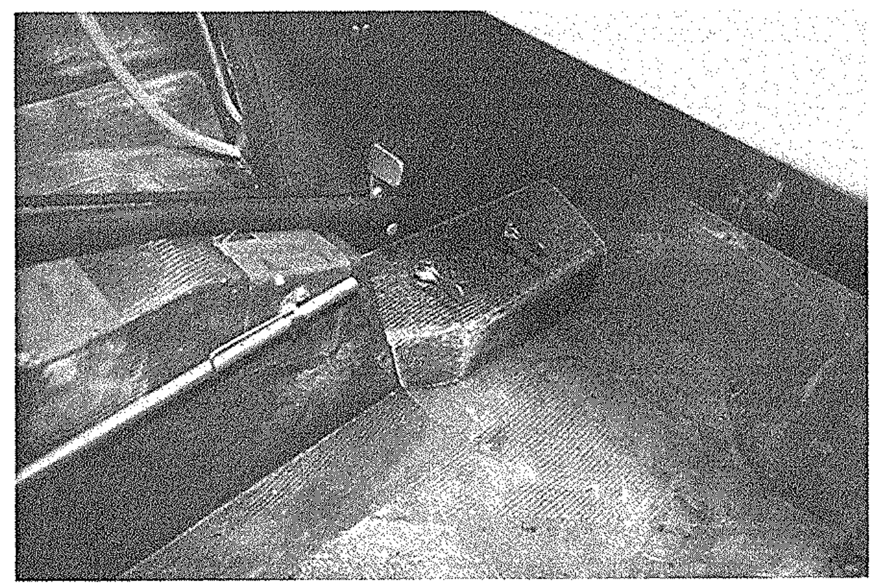
406. Throttle quadrant with push pull cables attached. (SEE D-47). Fuel valves before mounting.



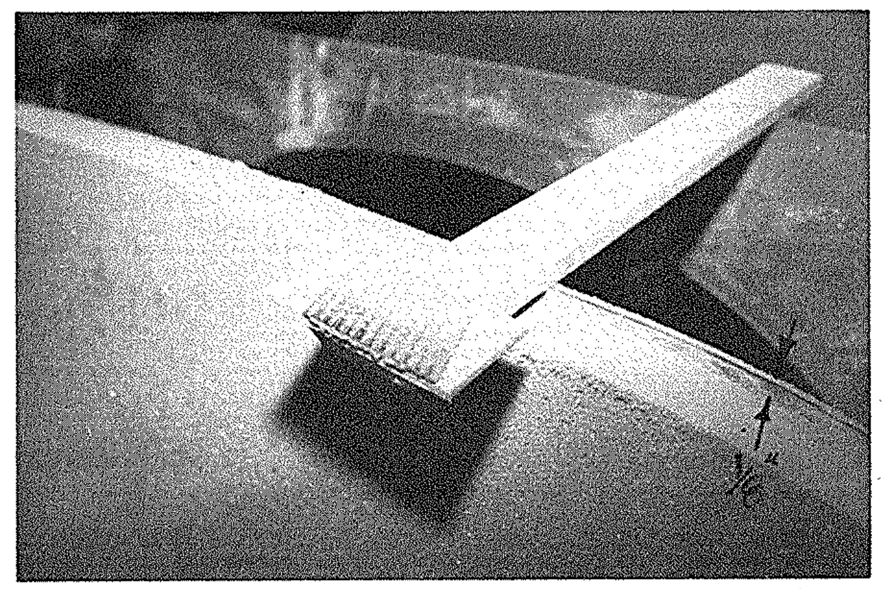
407. Center console side (front) showing recess area for throttle quadrant. (SEE D-45 and D-47).



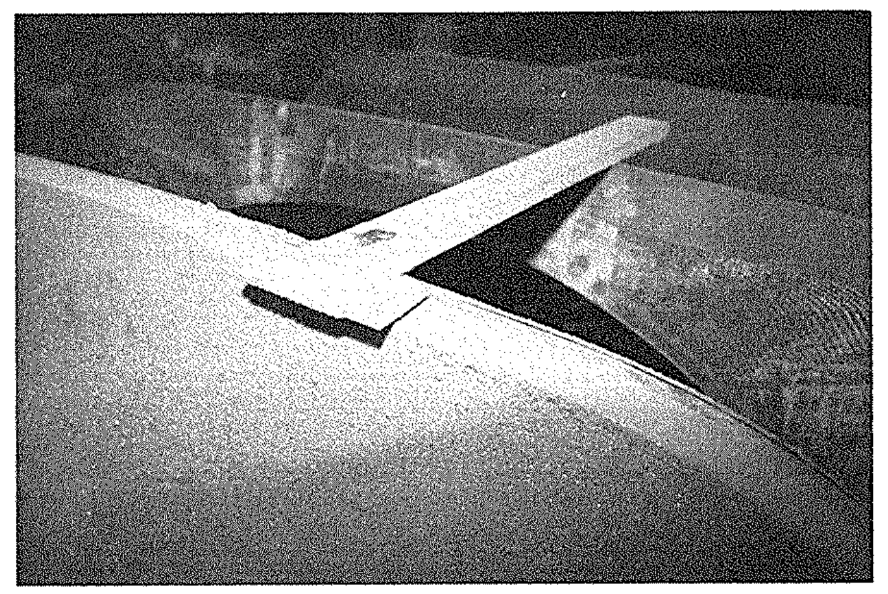
408. Throttle quadrant temporarily set up in center console to check fit.



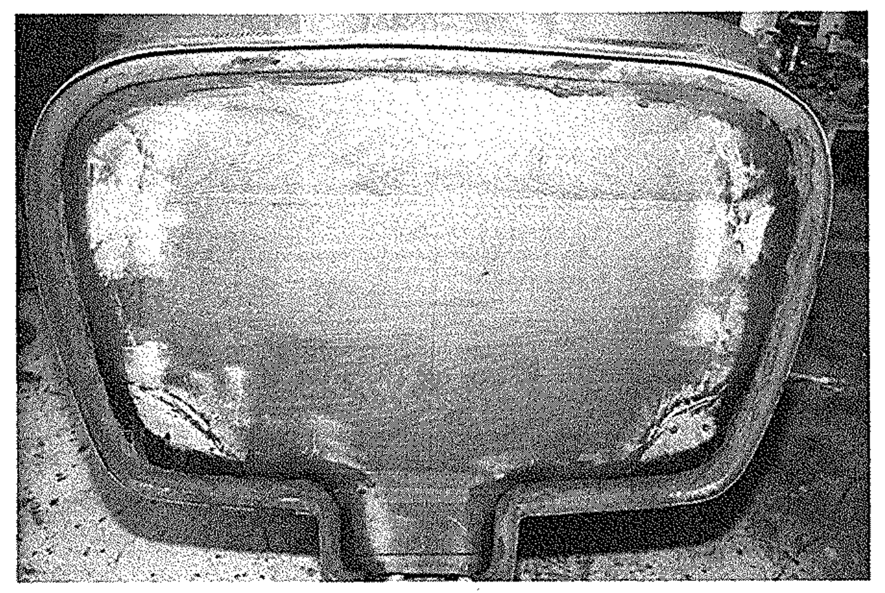
409. Fuel valve cover. 1/4" R45 with 1 PLY BID on outside, only use small wood screws to hold to wooden fuel valve fixtures. (SEE D-38).



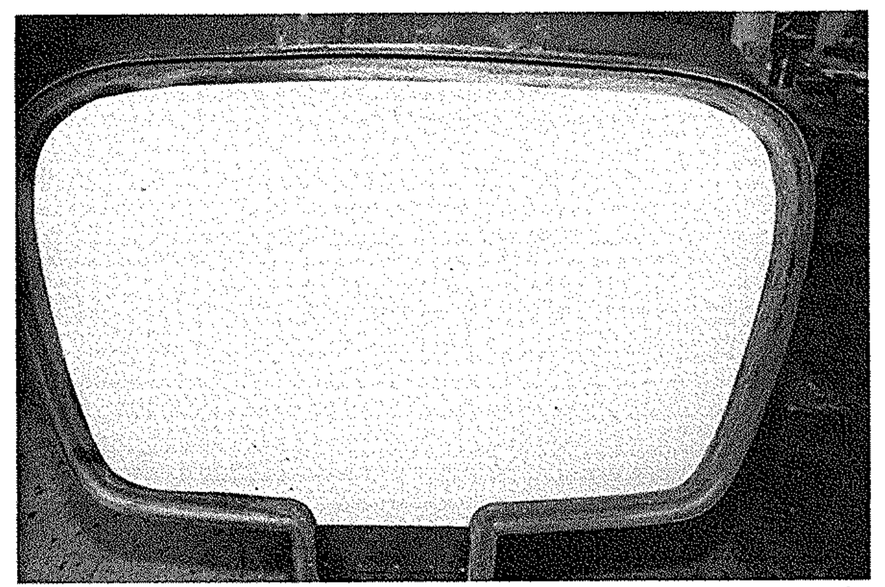
410. Make cowl lip tool as shown in photo and on Page D-26.



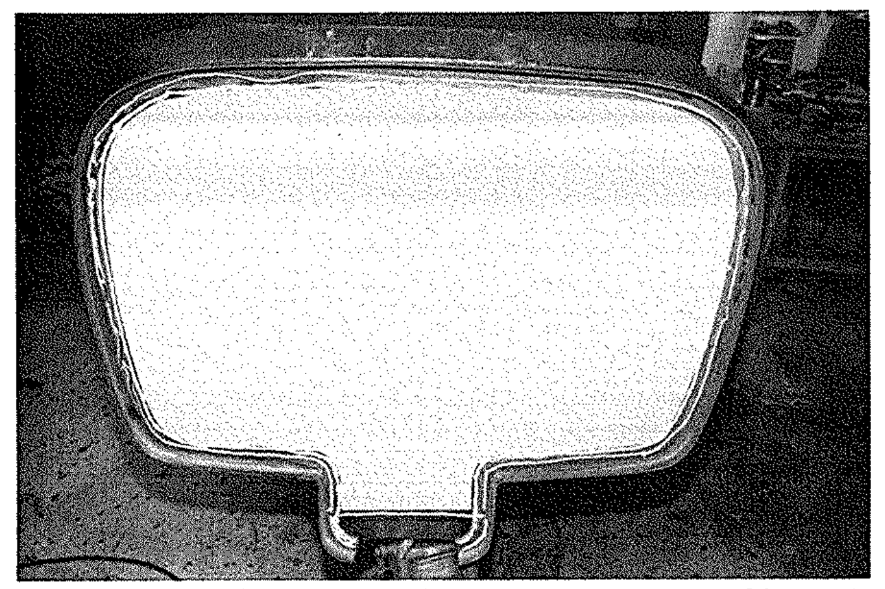
411. Sand temporary foam down from edge of firewall 1/8". Apply peel ply and 2 plies BID at 45° tape as shown in details on D-26.



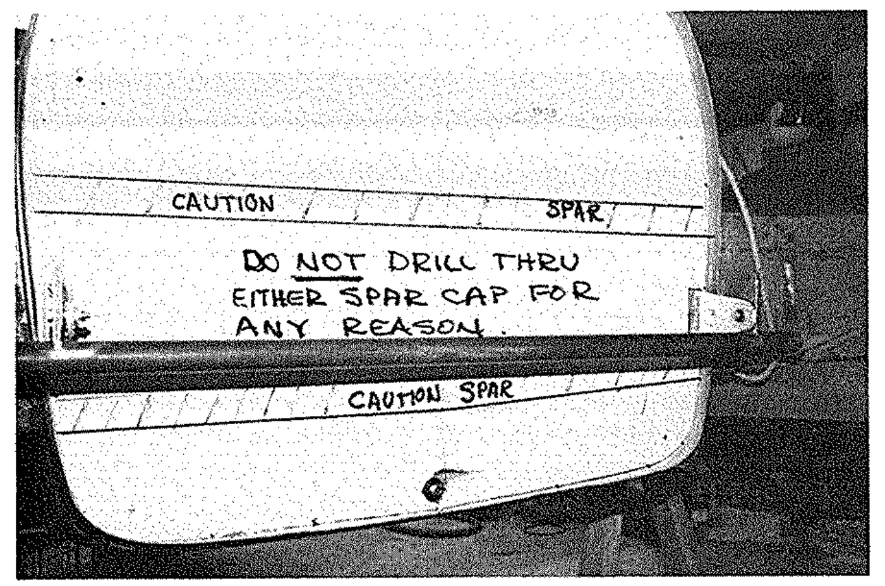
412. After 2 plies BID lip has cured, remove foam and peel ply and layup 4 plies BID at 45° tape. (SEE detail D-26).



413. Cut out 1/16" Fiberfrax (fire proof material) to fit inside lip. Apply silicone to firewall and attach Fiberfrax.

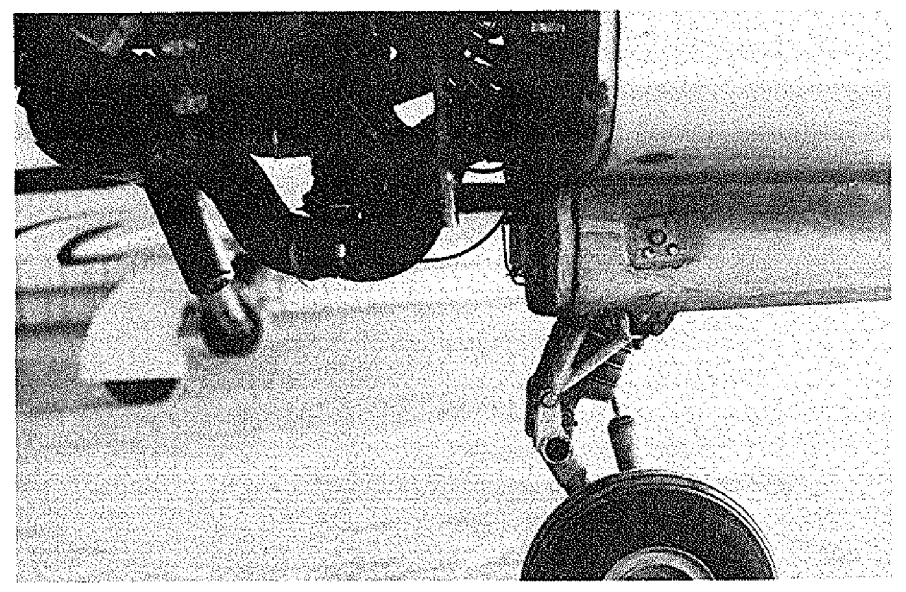


414. Apply silicone to Fiberfrax and around lip and attach (PRE SIZED) 1/16" stainless steel over entire firewall.

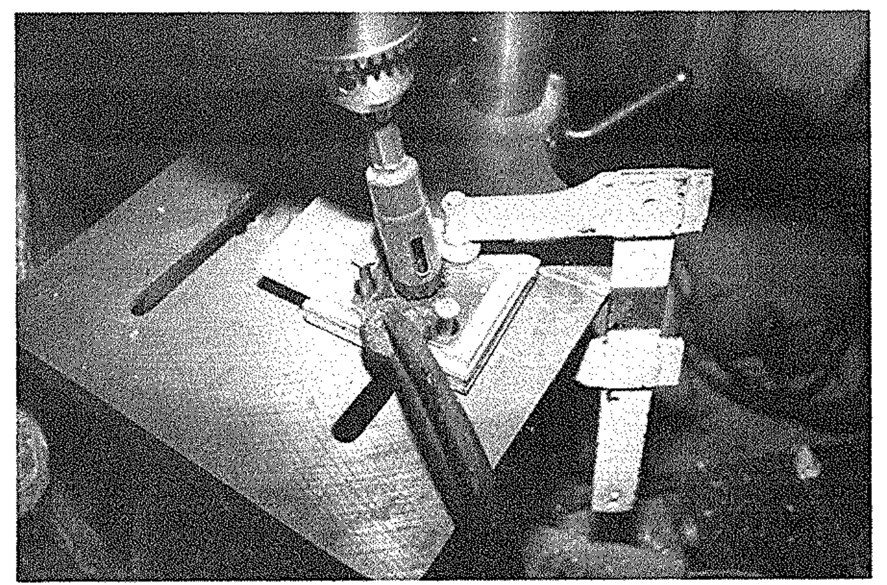


415. Aft firewall with stainless steel sheet in place. Note: Leave protective covering (plastic) on until plane is finished. Remove for clear bright surface. Mark area where spar caps are.

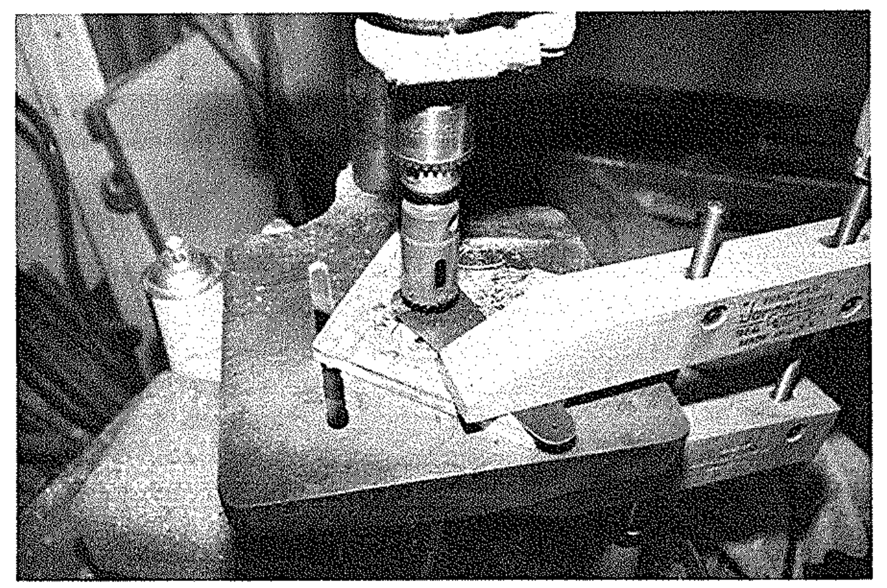
416. Cowling and cowl lip on N78RA. After engine compartment.



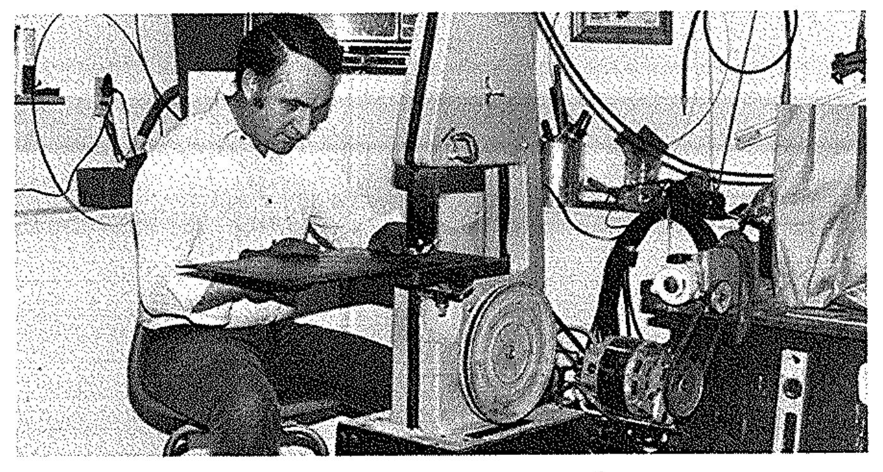
417. Cowl lip on front engine compartment of N78RA.



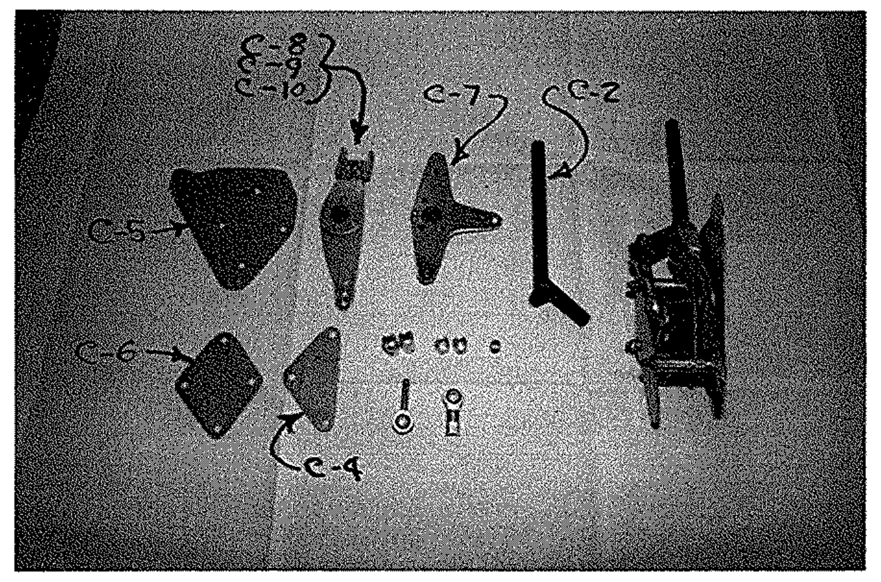
418. Using (Real McCoy) hole saw at 60 RPM to cut holes in various parts. Use cutting oil!



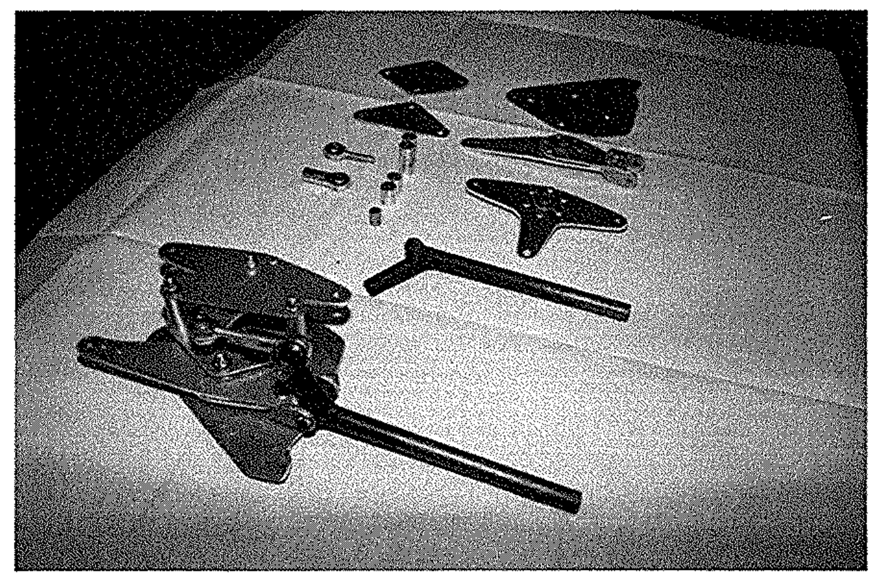
419. Make sure all work is well clamped to avoid injury or damage of part.



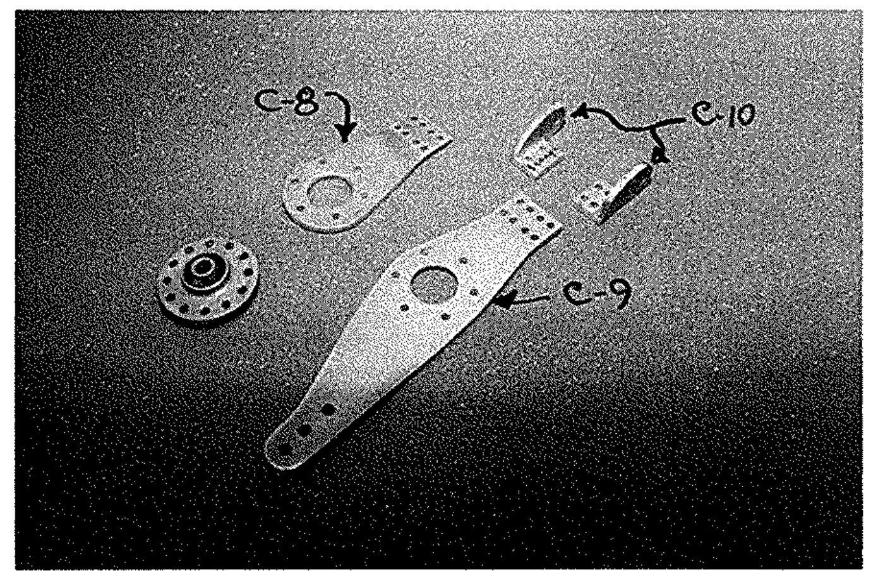
420. Cutting steel with Rockwell 10" wood band saw. Note egg beater motor running through idle motor then to large pulley. Speed required for 32 tooth blade is 75 to 100 RPM. All steel and aluminum for Defiant #002 was cut with this arrangement.



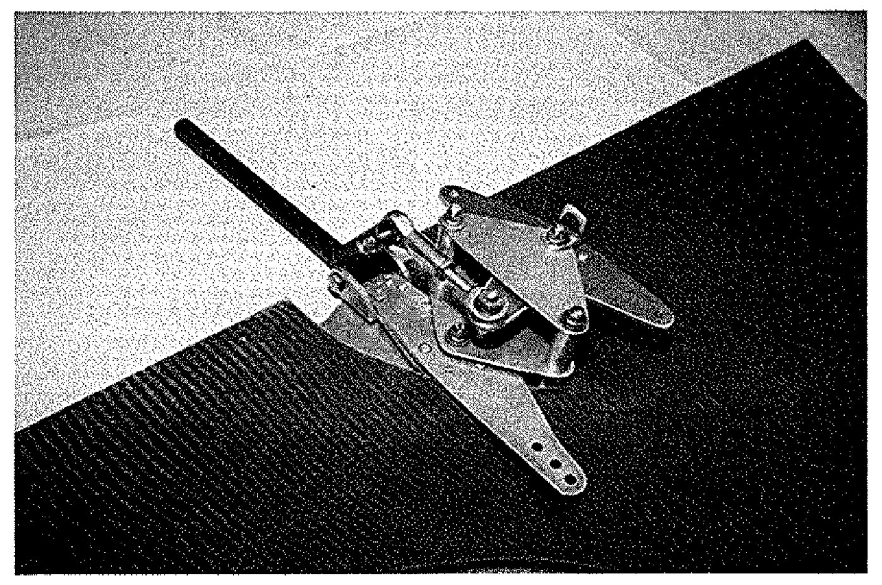
421. Showing parts of left control stick and assembled right control stick. (SEE D-48).



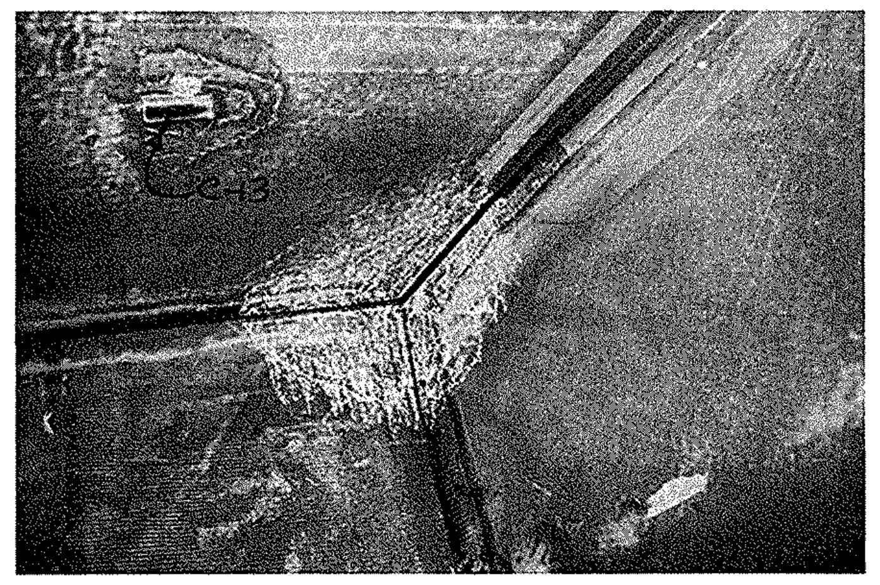
422. Different view of Photo #421.



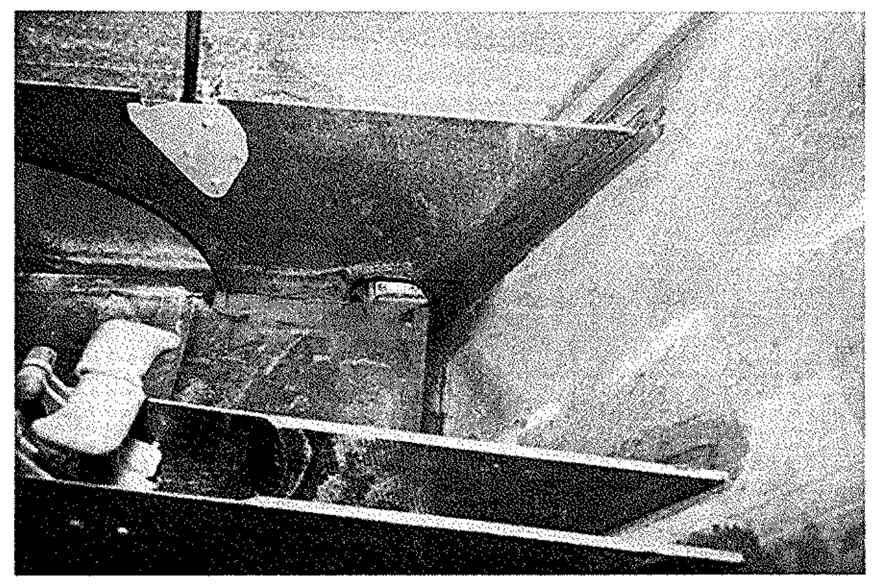
423. Parts of control stick assembly. (SEE D-48)



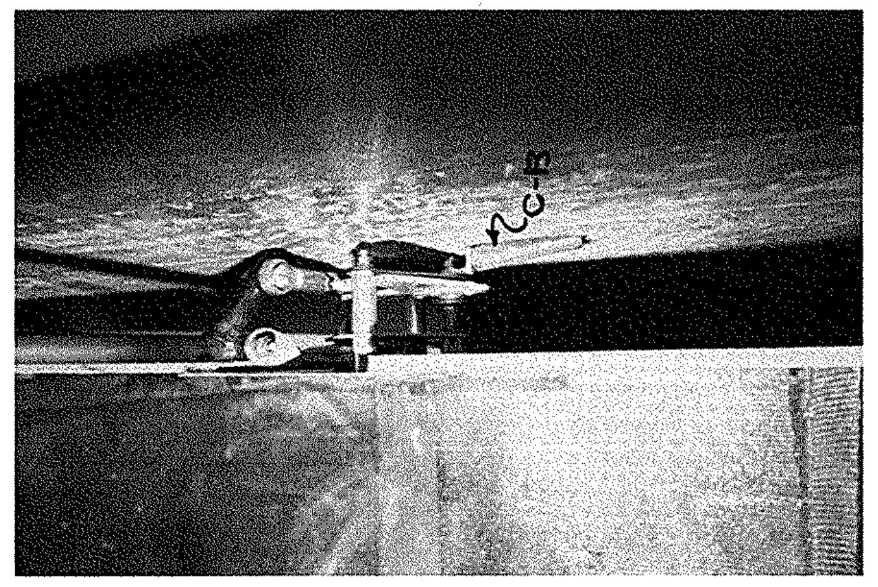
424. Left control stick in position in side console panel.



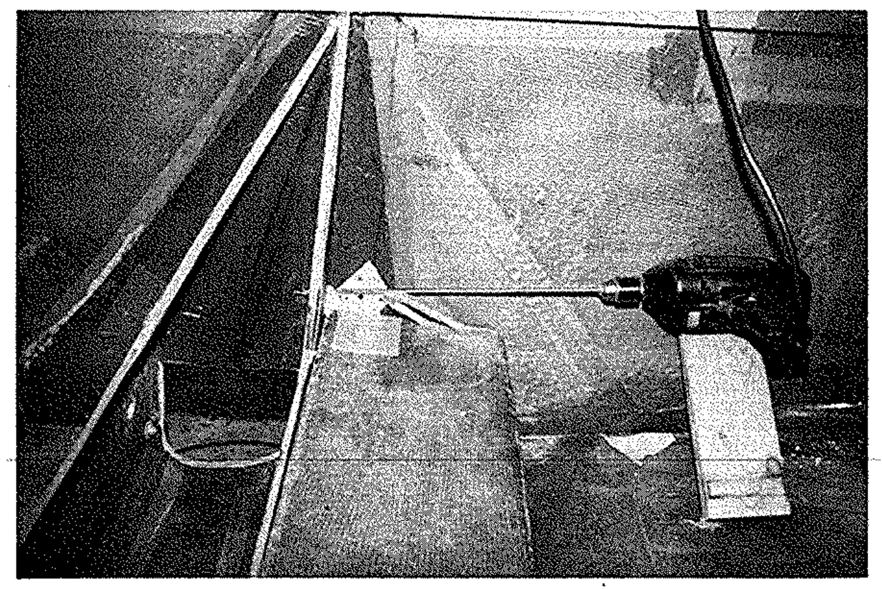
425. Shows location of C-13 (SEE D-48) and how area where seat belt attach layups should be roughed with 36 grit sand paper. (SEE D-46)



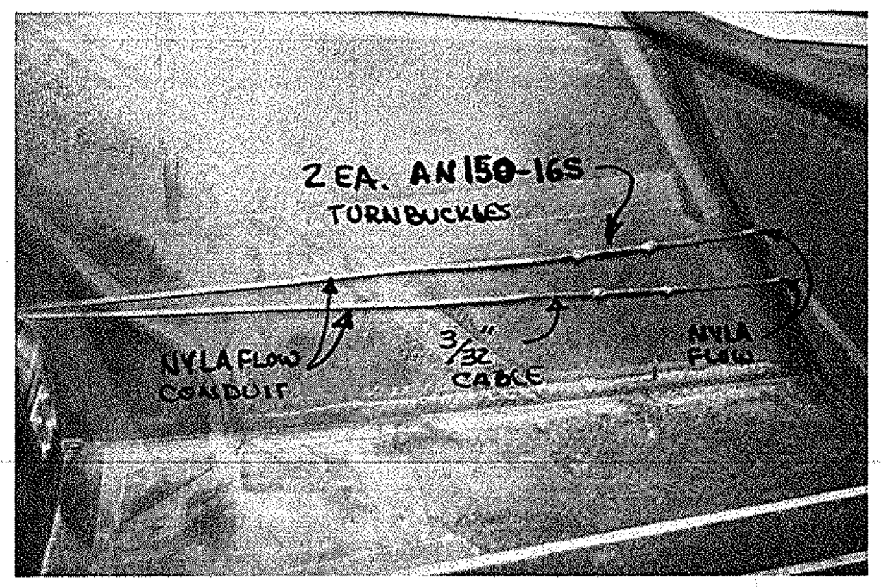
426. Right Side (FRONT) seat belt attach with right side panel in place. (SEE D-8). Side panels are in straight line from front to rear.



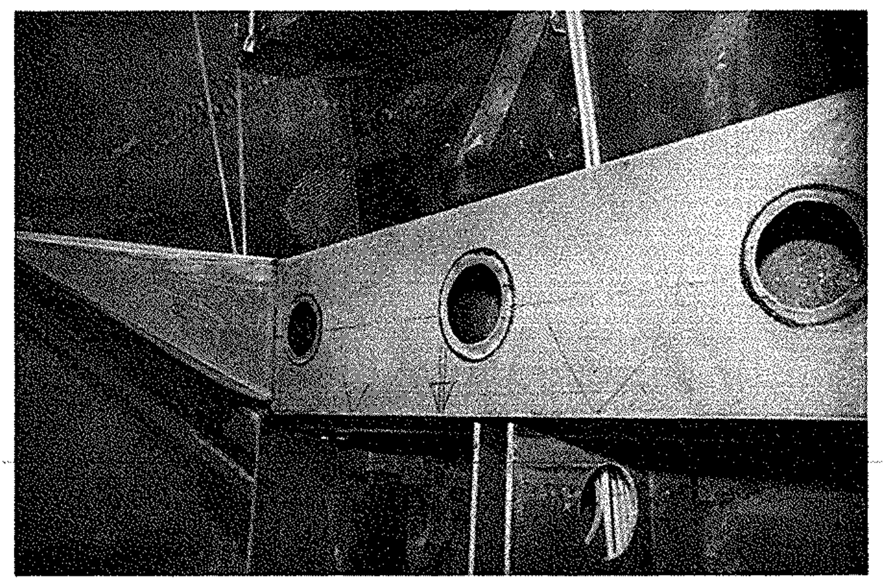
427. Right side stick, Note C-13.



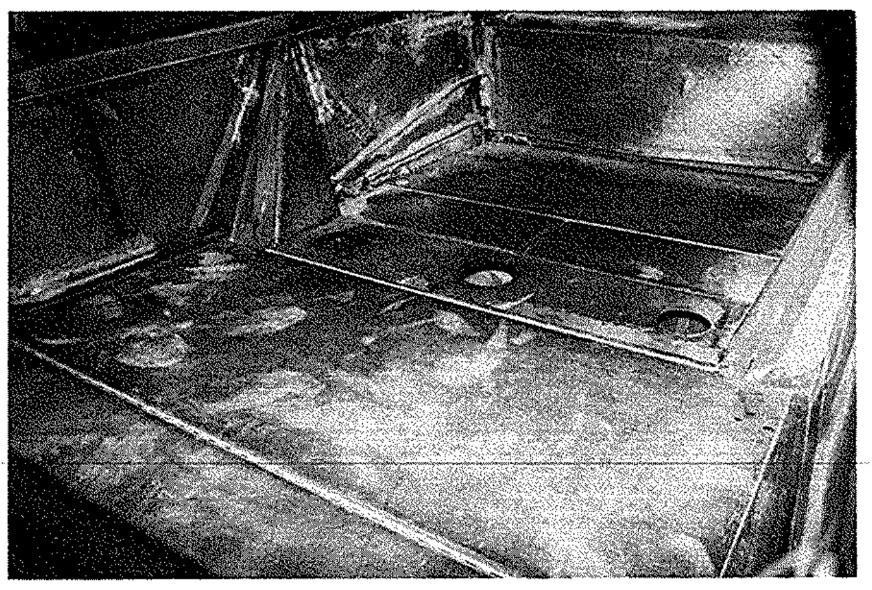
428. Drilling 1/4" holes for NYLAFLOW (aileron cable conduit).



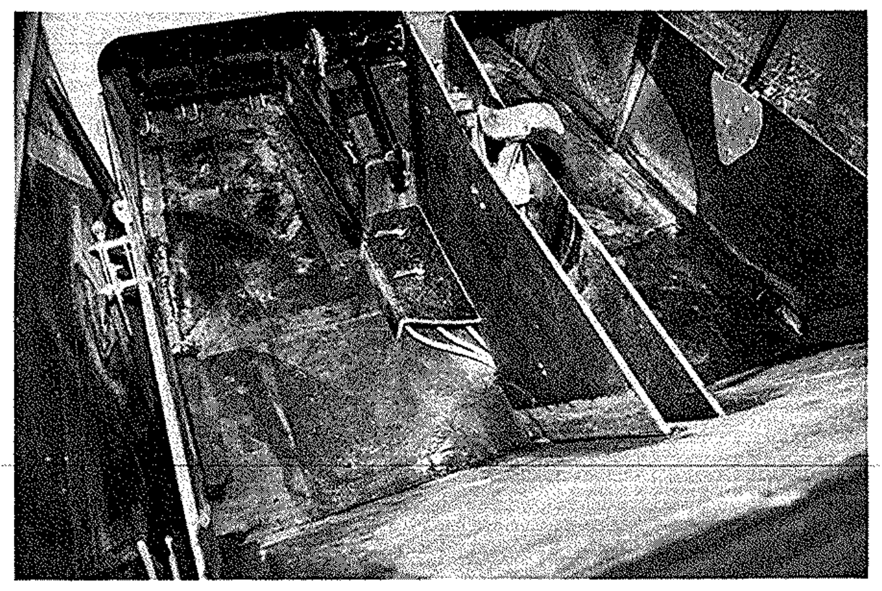
429. Aileron cables from aft firewall to control stick. (SEE D-48 and D-26).



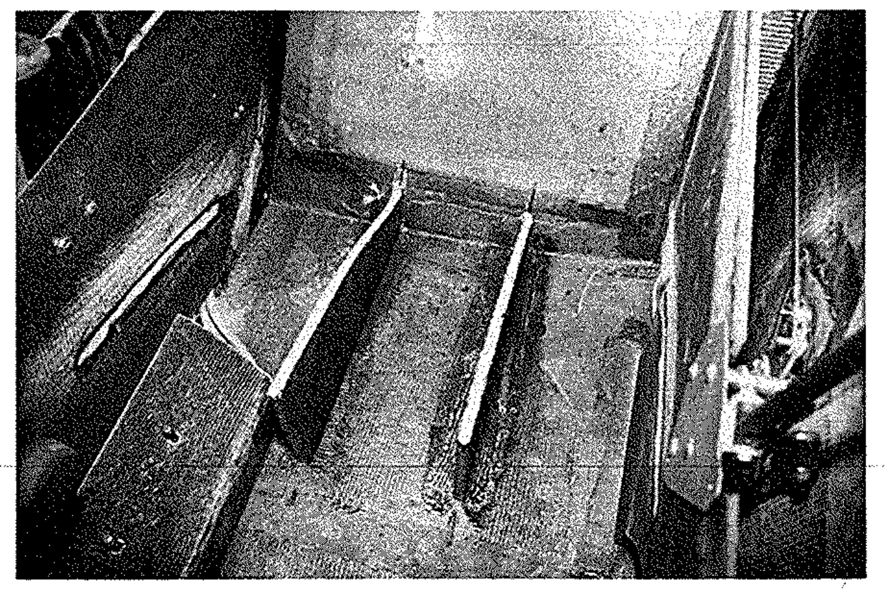
430. Covering main landing gear box. Note access holes to check landing gear attach points and sump tank connections. (SEE D-46).



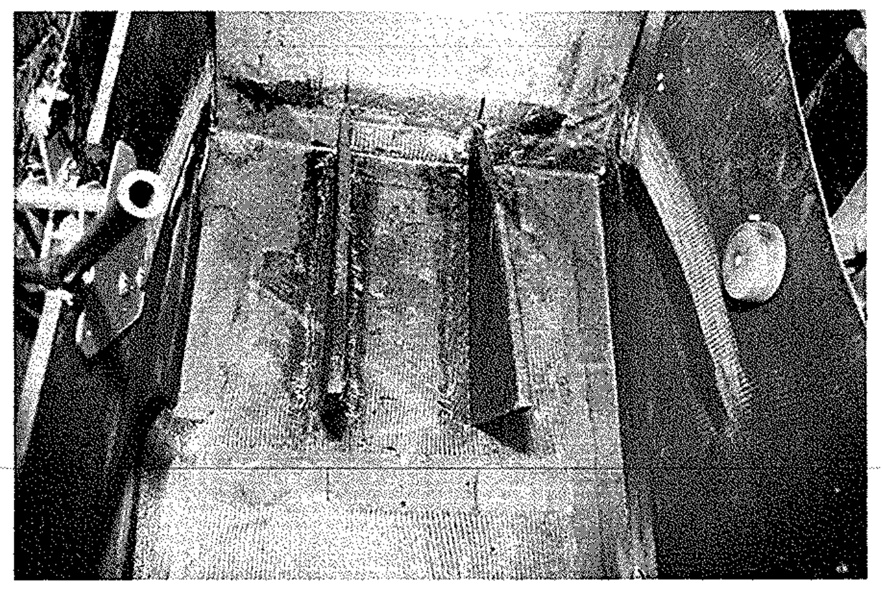
431. Back seat folded down into bed arrangement. (SEE D-46).



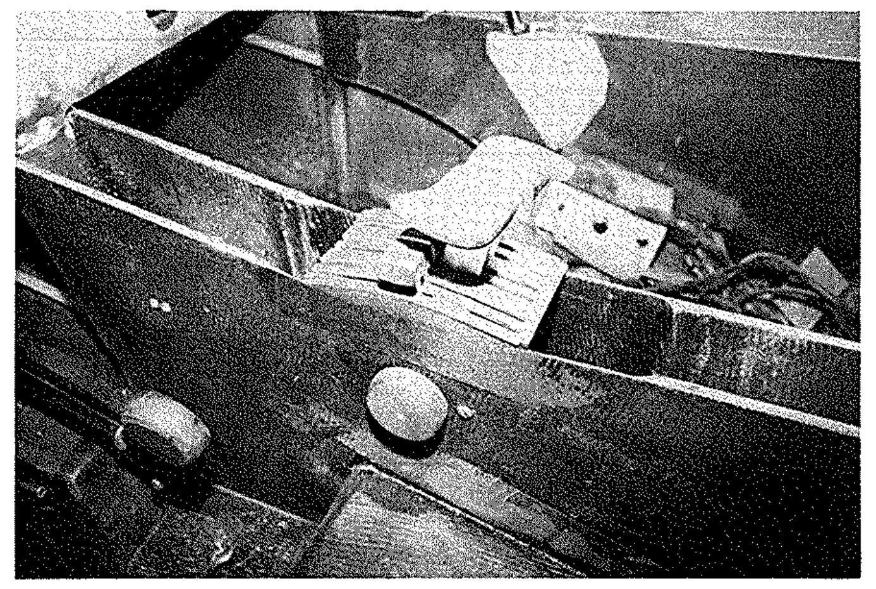
432. Front seat area with console going in place. Note center console has an offset to match instrument panel. (Study D-8 top view).



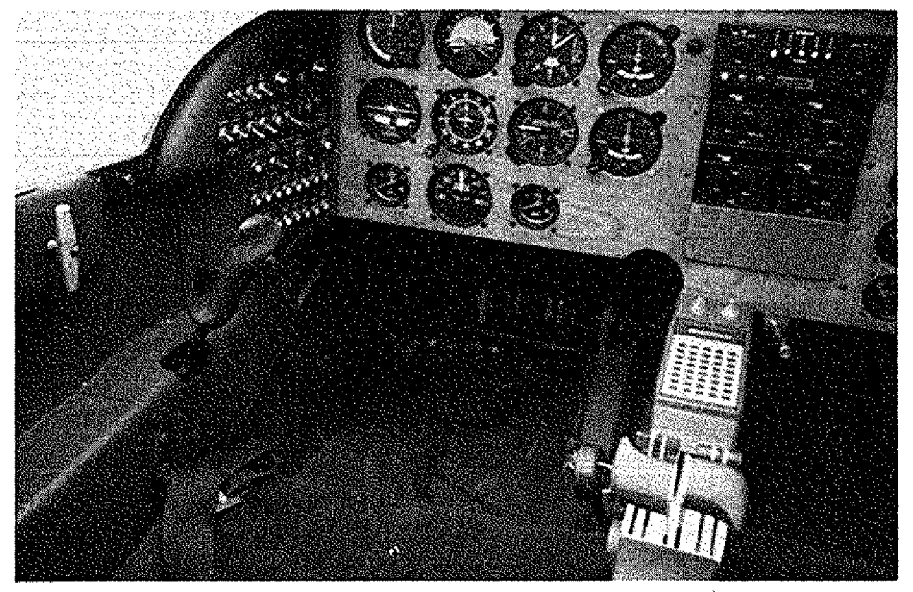
433. Seat supports under pilots seat.



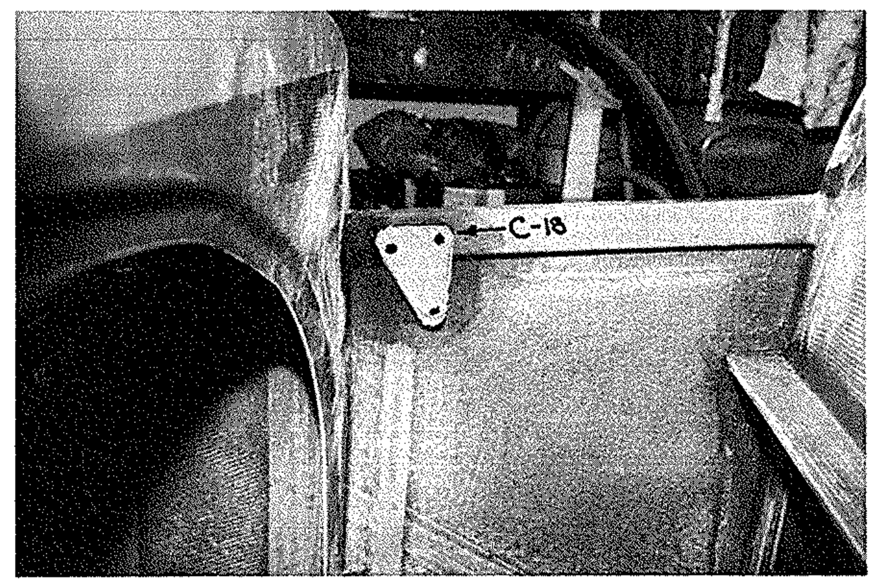
434. Seat supports under passengers seat. NOTE: Throttle quadrant friction adjustment knob has been relocated to pilots side. (SEE photo #435).



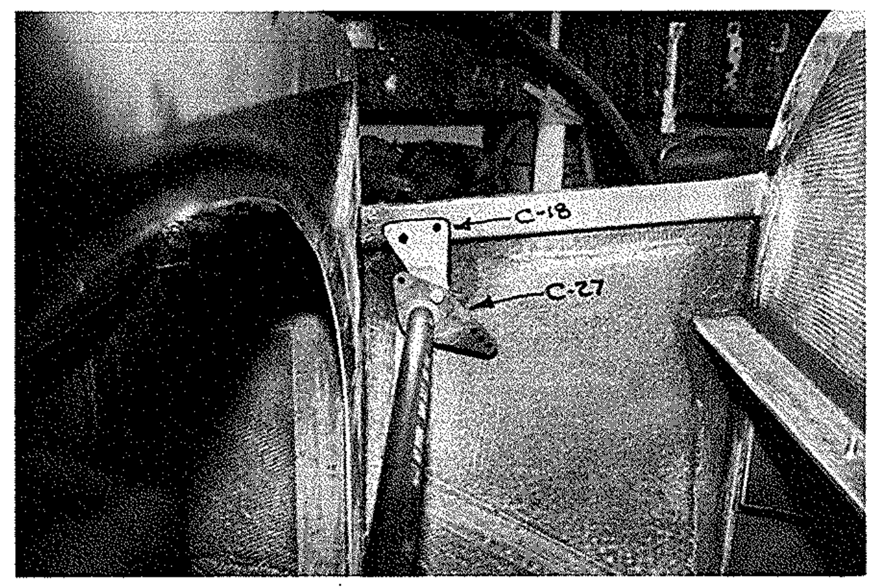
435. Throttle quadrant and its friction adjustment knob. (SEE D-47).



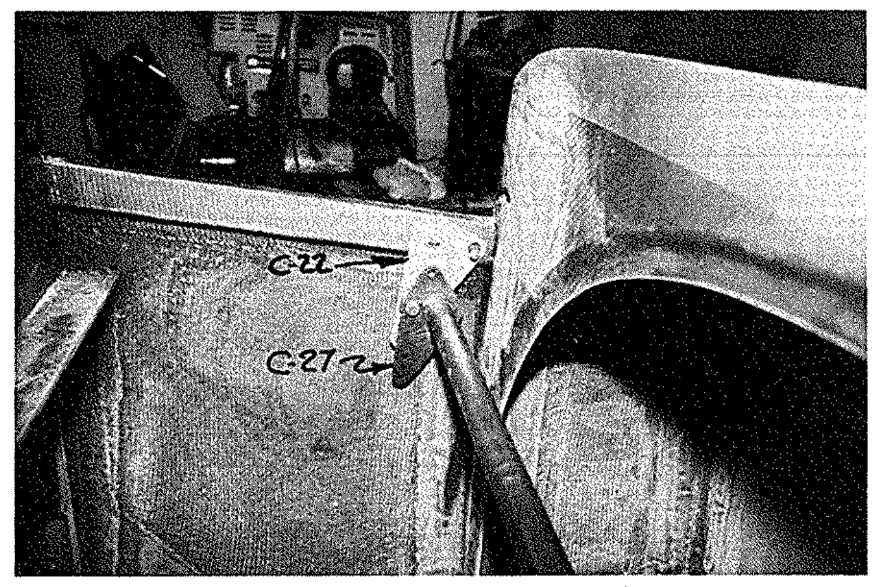
436. This illustrates how Defiant #002 was completed inside. Further photos of cabin area are on Page C-15.



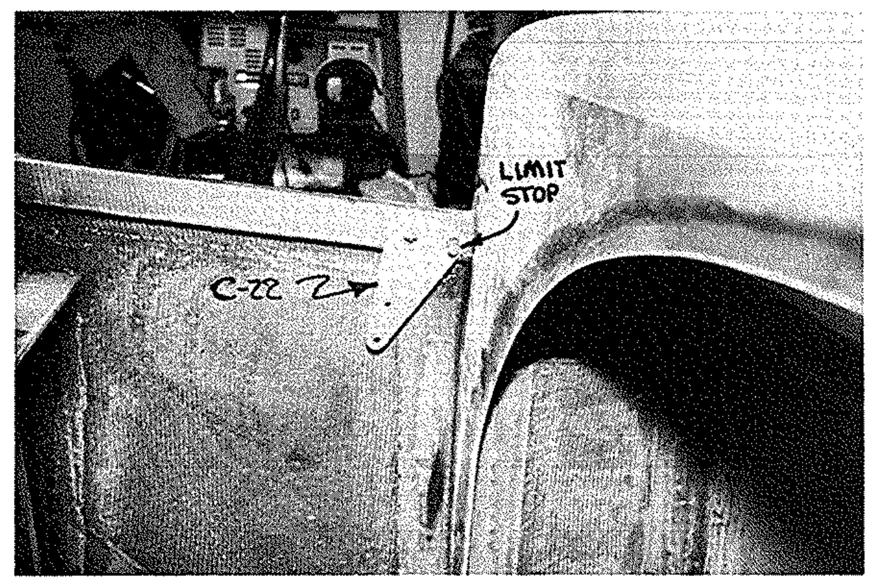
437. Placing C-18 on right side of fuselage aft of BULKHEAD 57. (Canard attach bulkhead). (SEE D-27)



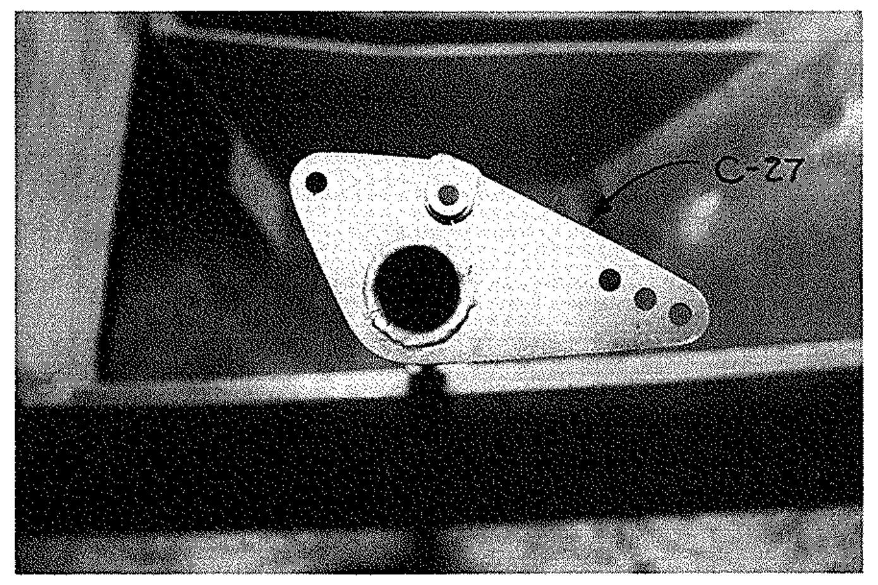
438. Right end of C-27 (Elevator actuation torque tube).



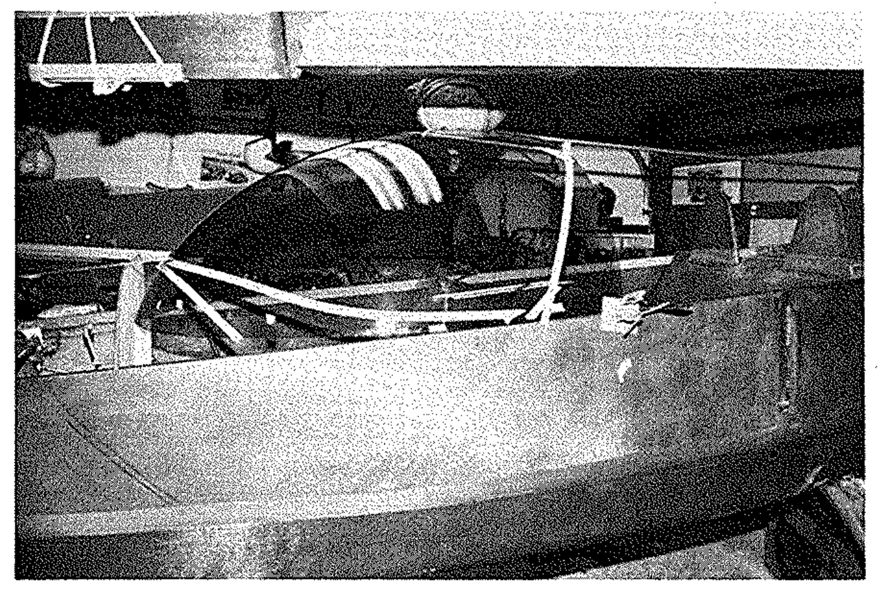
439. Left end of C-27. (SEE D-26).



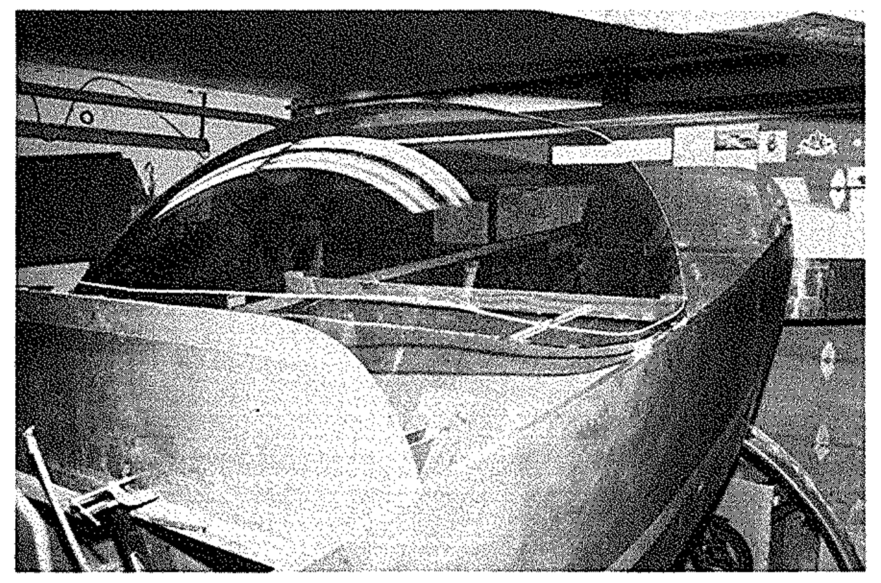
440. The operation of C-22 changes the relation (position) of the left elevator to the right elevator to give roll trim control. (SEE D-26).



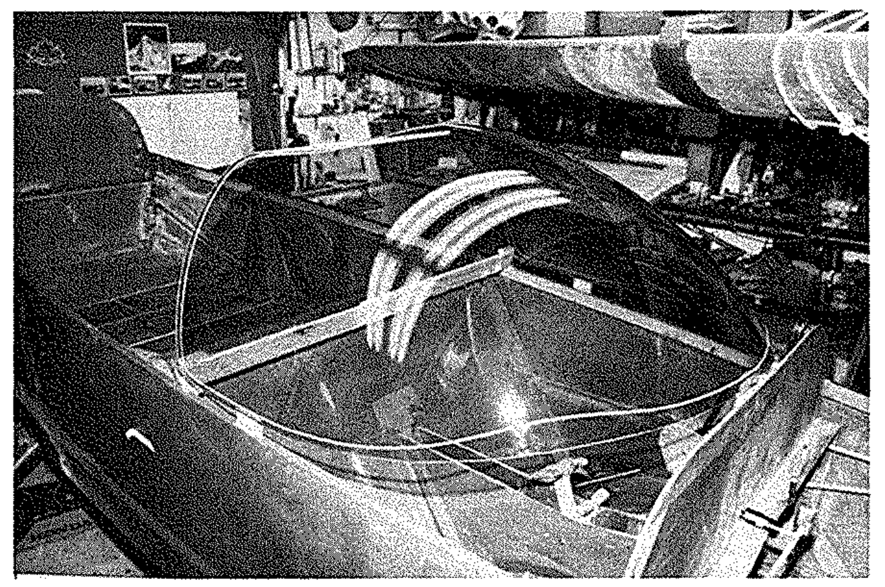
441. Left end of C-27. Note added bearing surface for 1/4" pivot bolt.



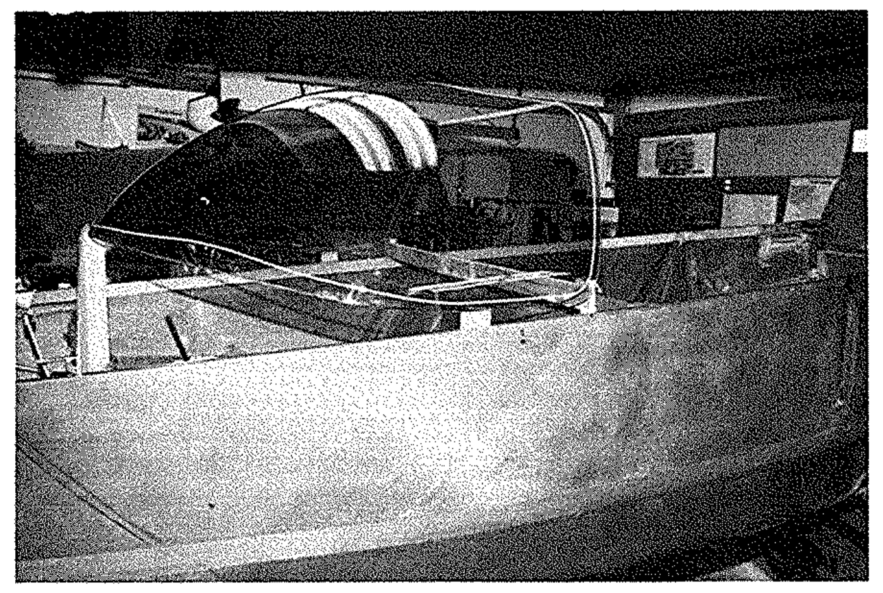
442. Rough positioning of canopy. Allow for required head clearance, rough air conditions and styling desired.



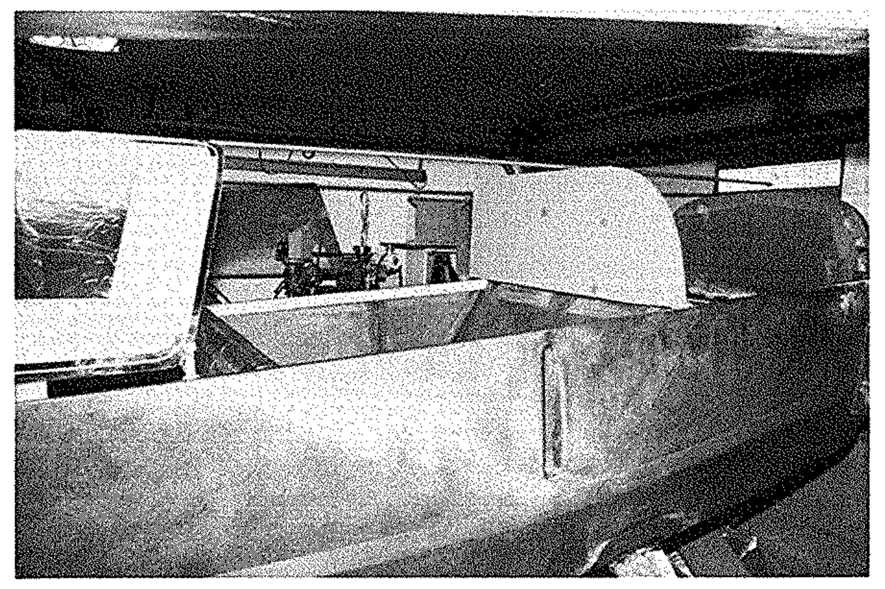
443. Use 1/4" masking tape as a visual aid to contour and shape canopy outlines. (SEE D-49).



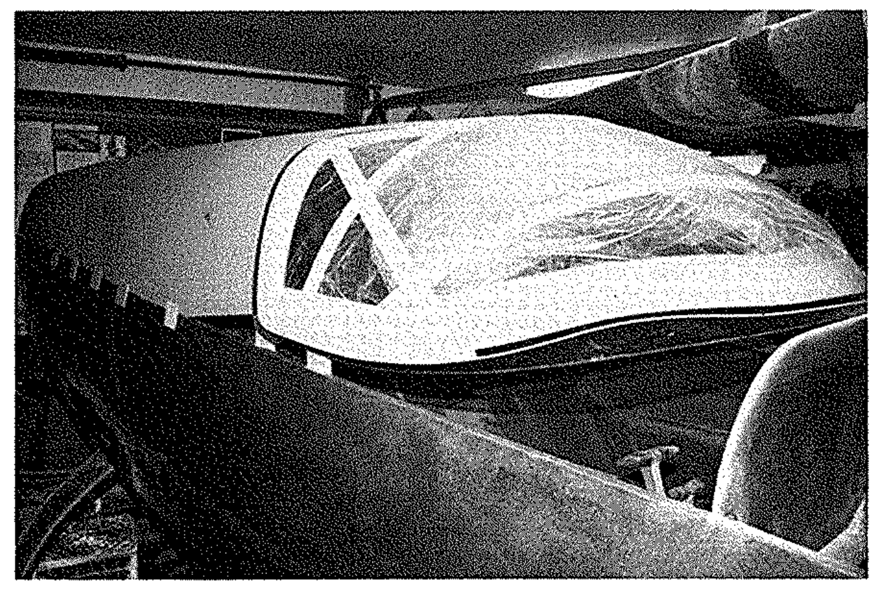
444. Carefully cut plexiglass with dremel motor and saw blade attachment (#199). Protect surface of canopy and most important your eyes before doing any cutting.



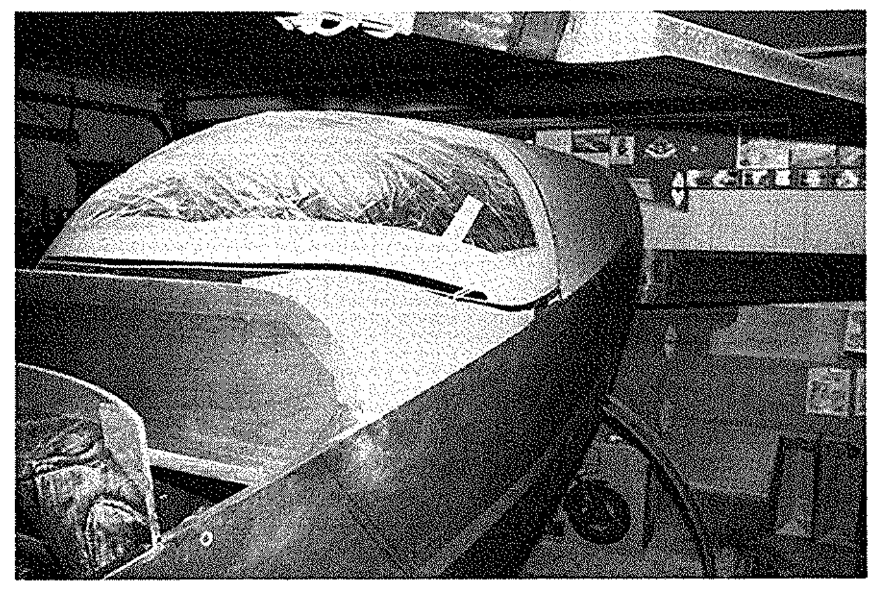
445. Once desired position and shape is selected temporarily attach canopy to fuselage.



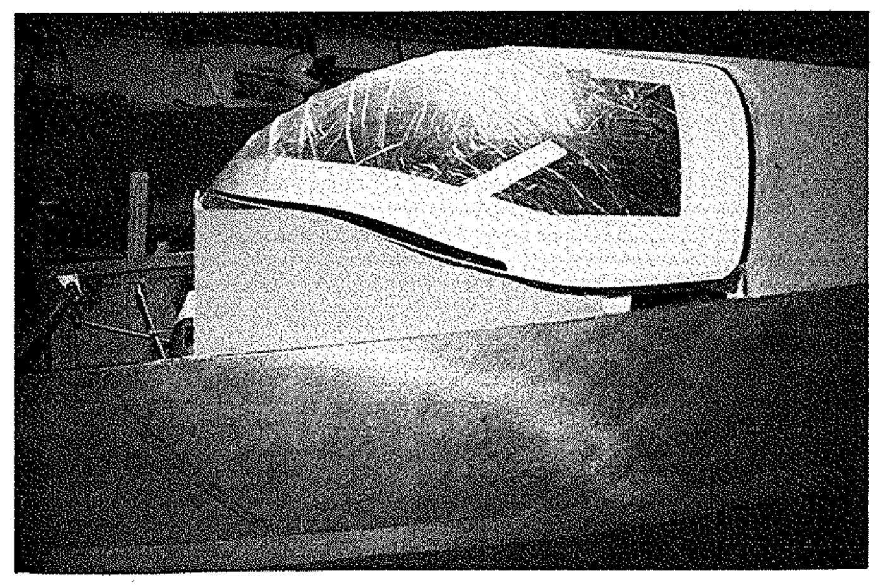
446. Forming shape of false bulkhead for stringers as shown on D-49.



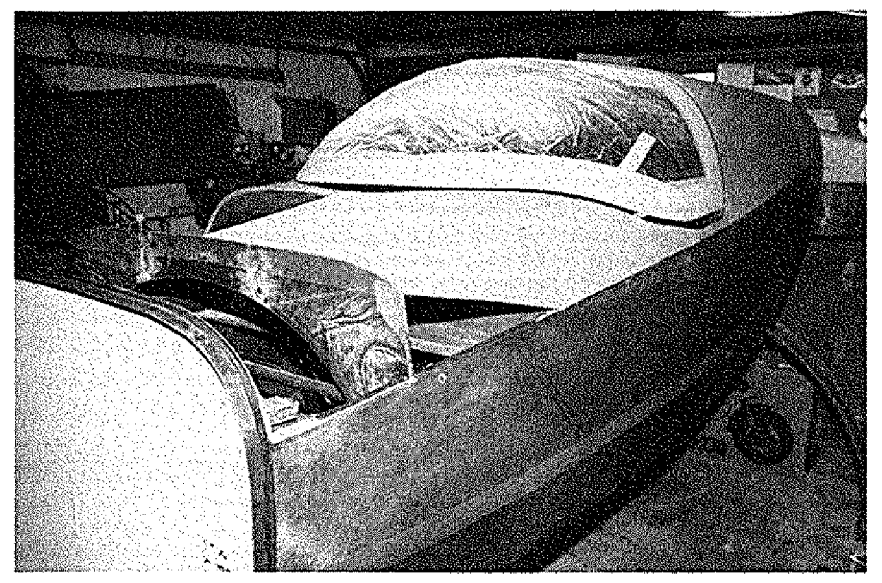
447. Carefully protect canopy plexiglass at all times. The extra caution is well worth it. Form 3/8" R45 foam cover (turtle deck) over stringers.



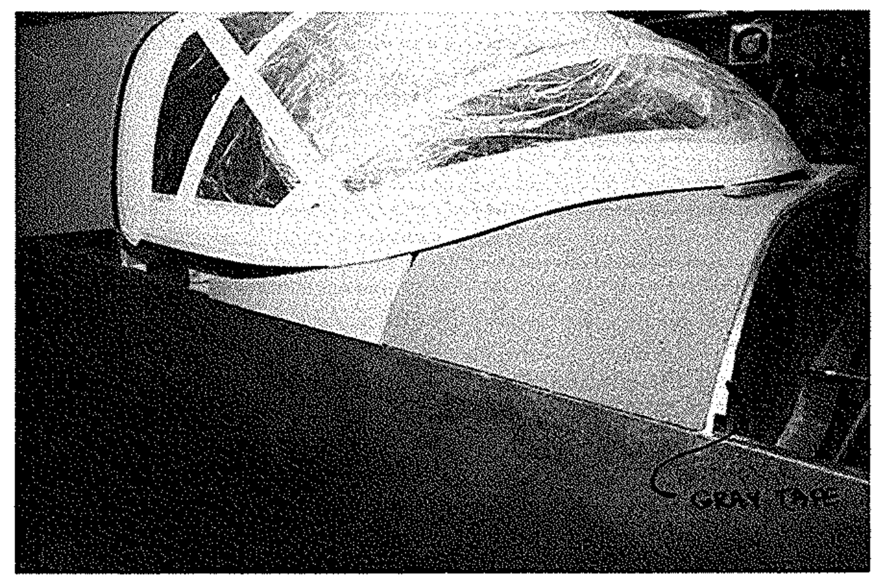
448. Apply heat to inside surface of foam. Hair dryer, heat gun or iron to form foam to fit.



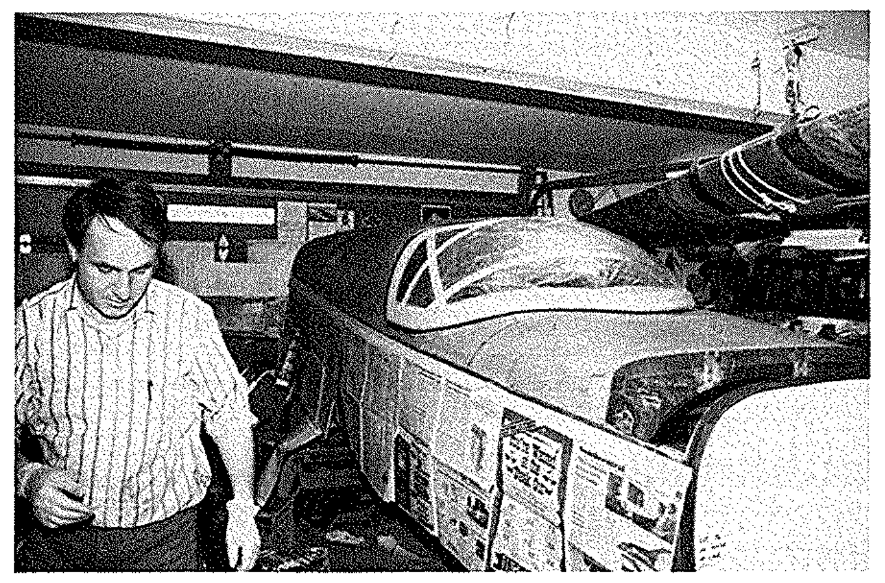
449. Continue adding to deck until completely covered.



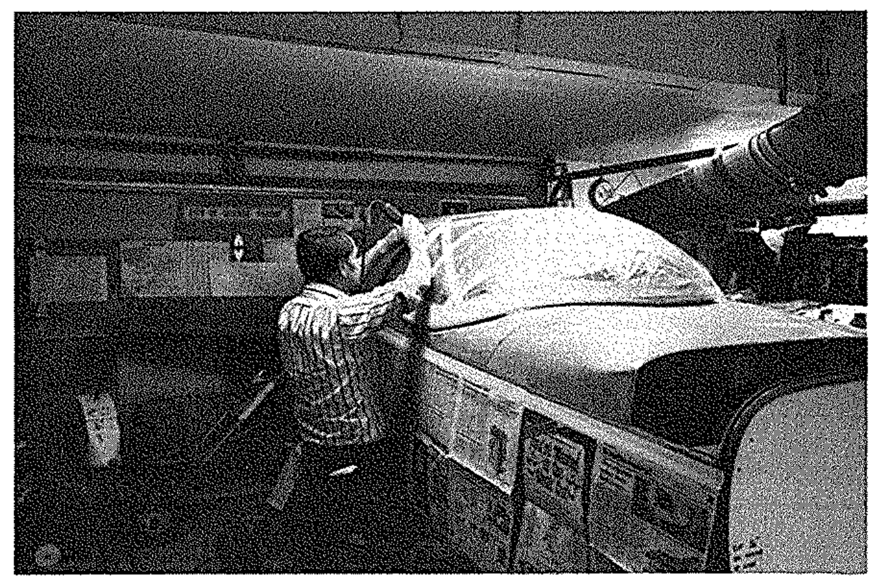
450. Turtle deck continued.



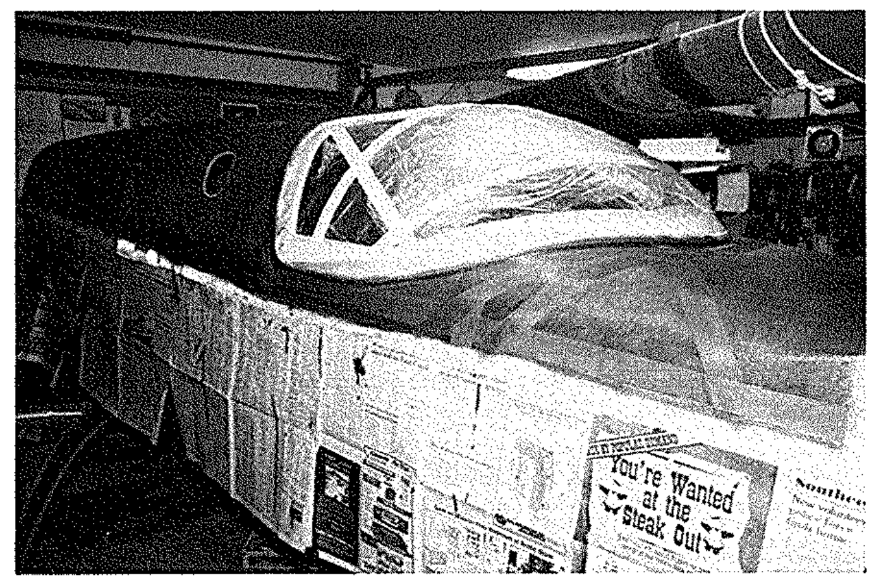
451. Use grey tape to act as release on parts suspect to glue or unwanted adherence.



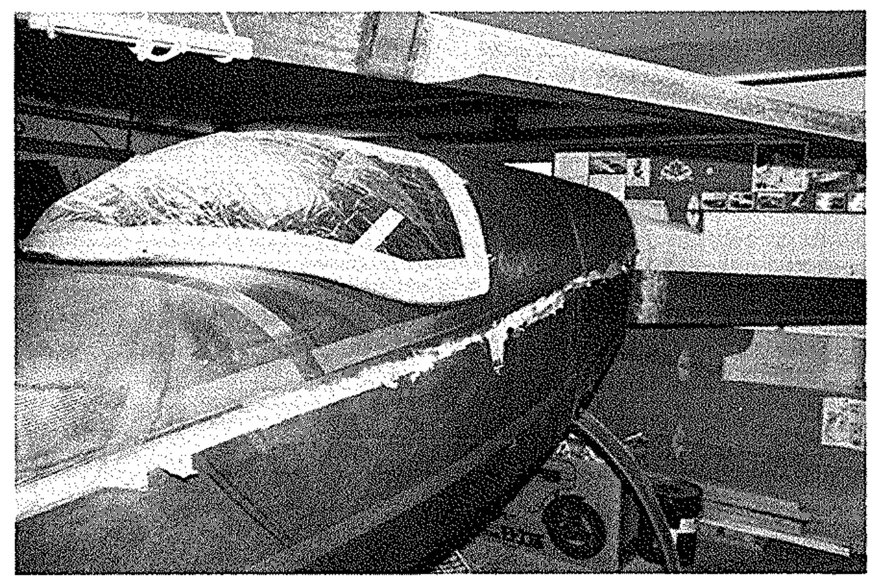
452. Protect sides with newspaper. Slurry all foam surface (TYPICAL) and do entire layup ① as shown on D-49.



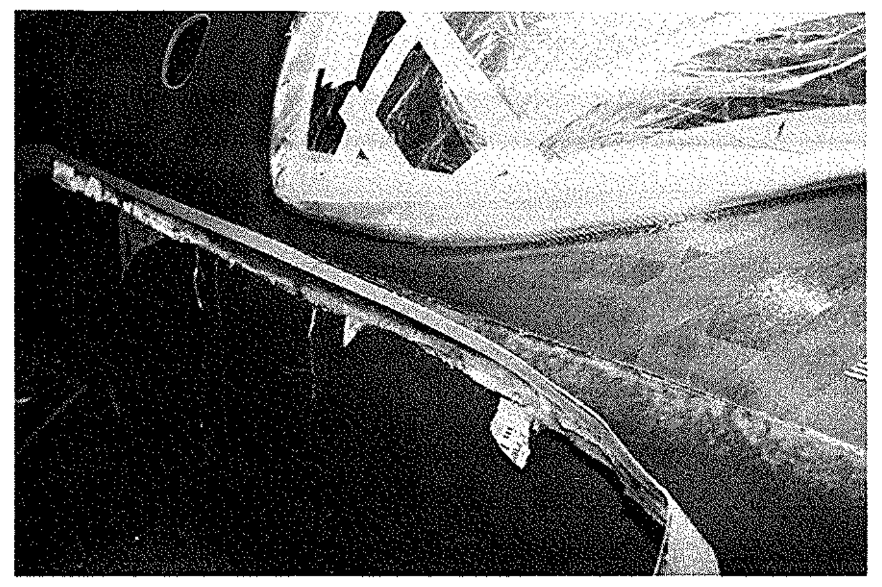
453. Last minute adjustment in foam to canopy before layup ①.



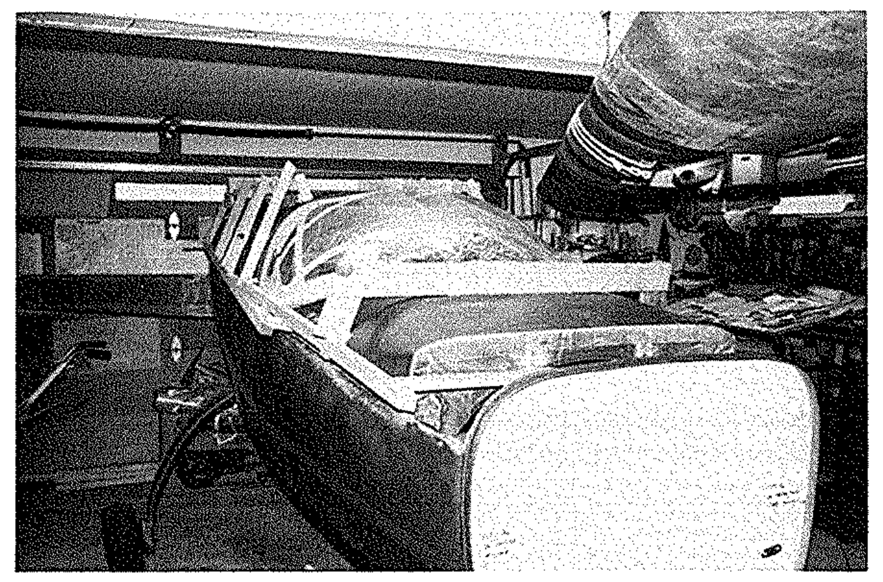
454. After layup ① has cured - outline shape of side windows.



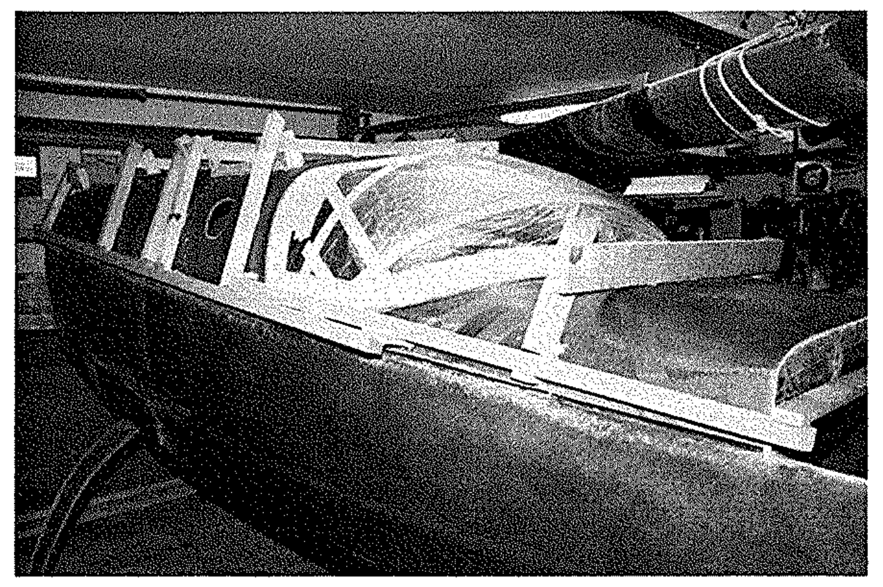
455. Turtle deck continued.



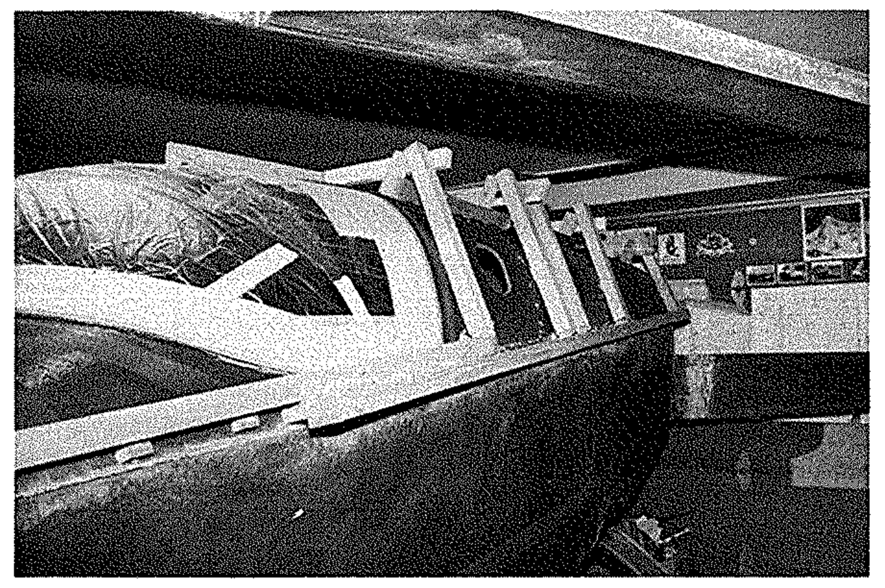
456. Trim off waste at top of longeron. Front to rear, both sides.



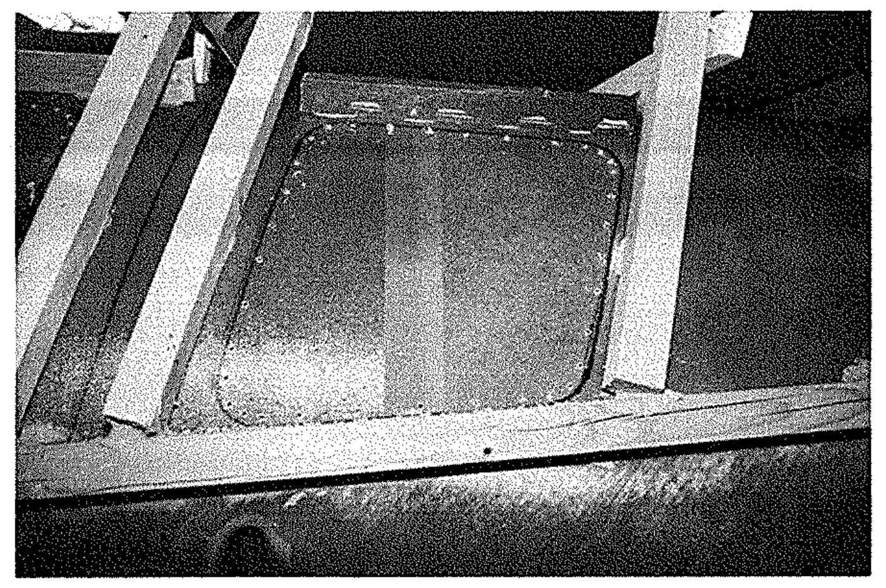
457. Build stiff back to hold shape of turtle deck. Deck has little strength until inside layup is done.



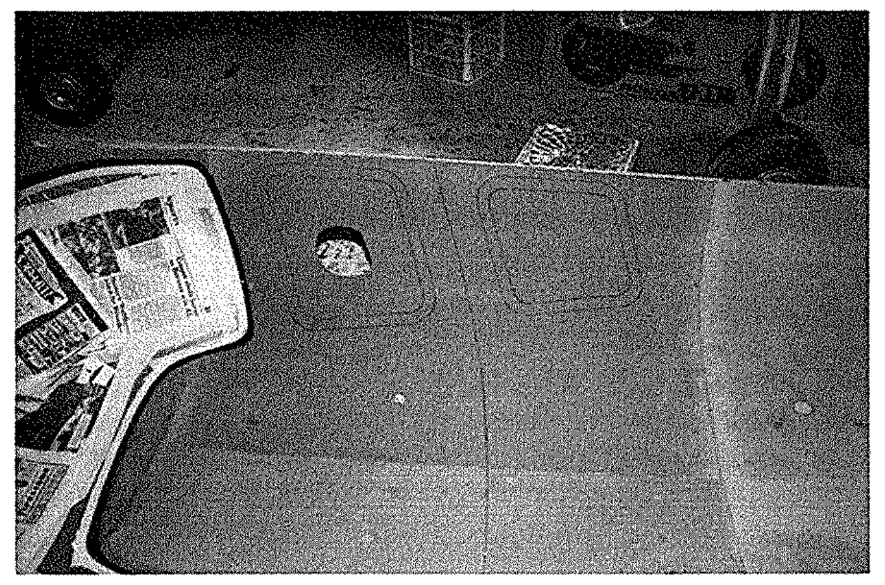
458. Bondo stiff back to skin of turtle deck. Make sure everything is well supported.



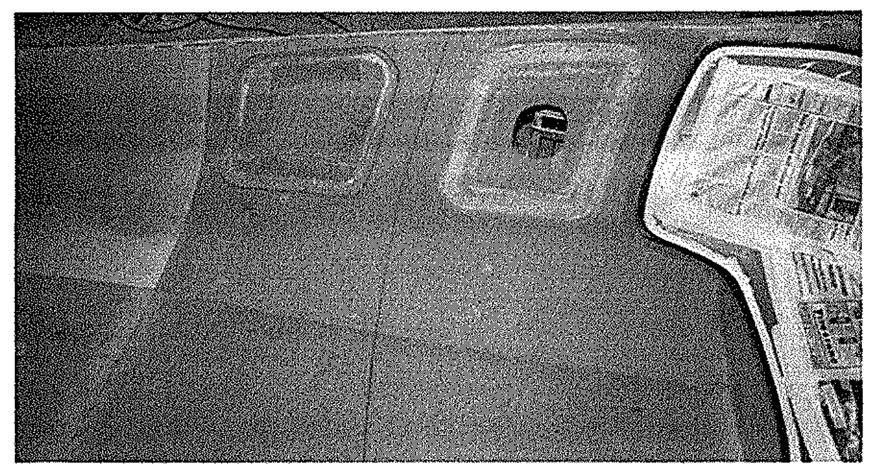
459. Note small access window cut into each side (inside side window outline) to see what is happening inside while breaking deck loose from "tub". (SEE Photo #467 for inside view of hole size).



460. Just inside outline of each side window, drill a series of 1/16" holes to transfer desired window outline to inside surface for reference.

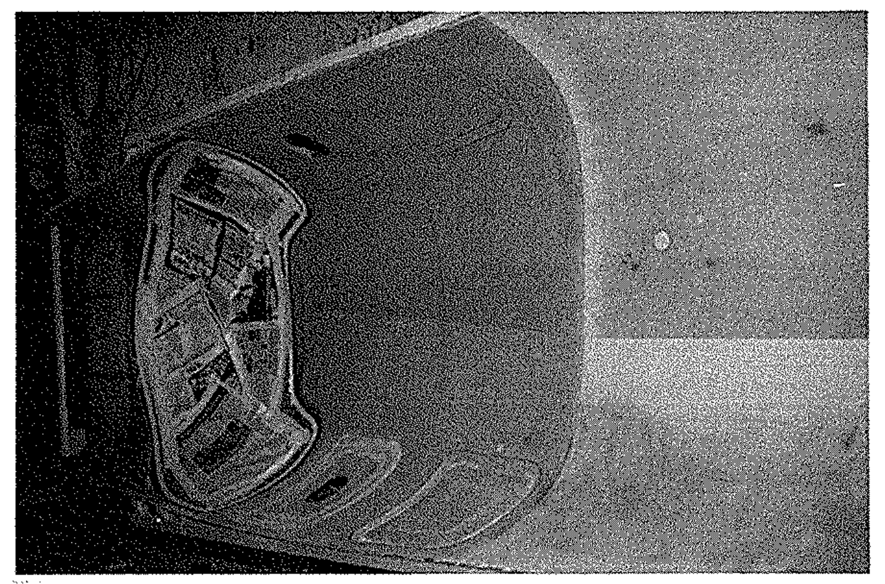


461. After turtle deck is removed, use reference holes to define window outline on inside. Mark outline with ink pen as shown.

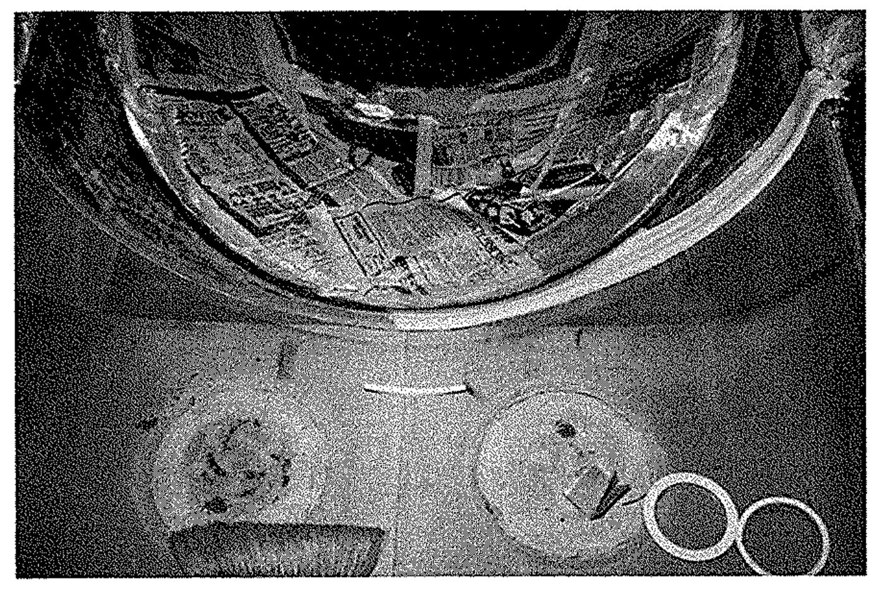


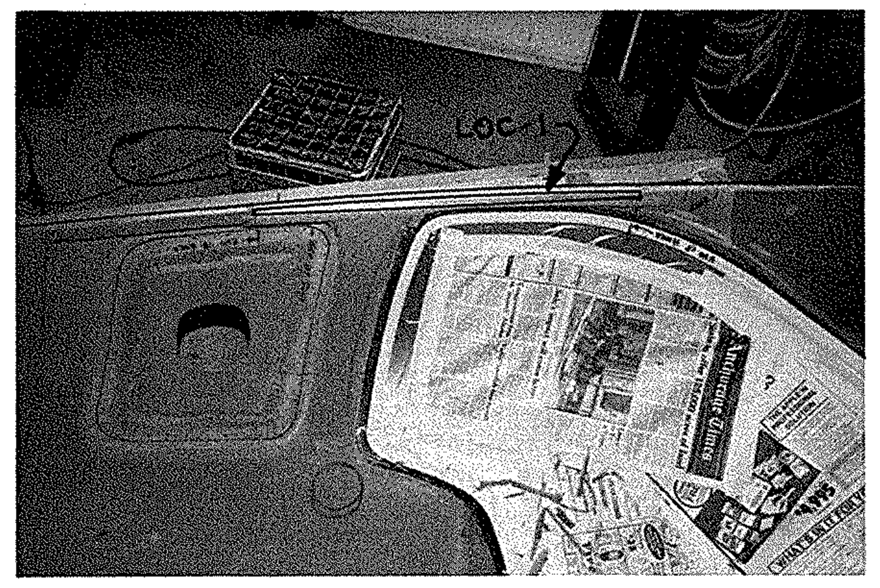
462. Note canopy opening line FORWARD and AFT is also transferred to inside VIA 1/16" hole along outside line.

463. Inside of canopy with turtle deck removed from "tub".


464. With window reference lines, remove foam around outline as shown in following photos. (SEE D-49).

465. Remove foam for round access holes and trim edge of canopy glass.

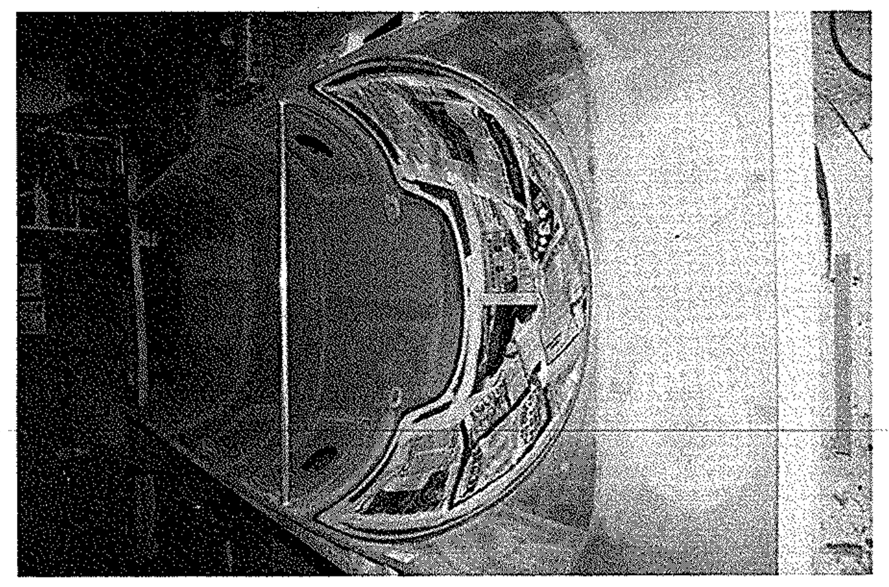

466. Protect inside surface of plexiglass.

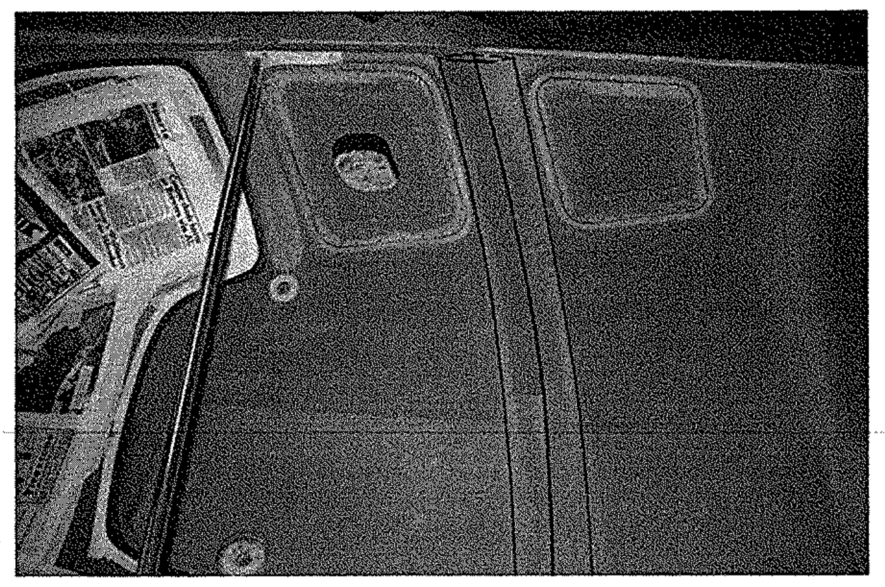


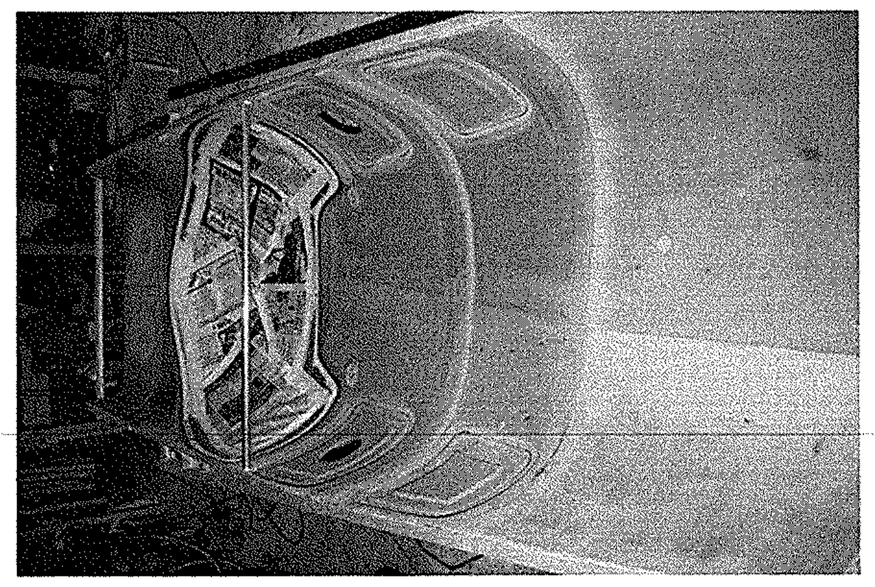
467. Install LOC-1 and route edges of canopy as shown on D-50.

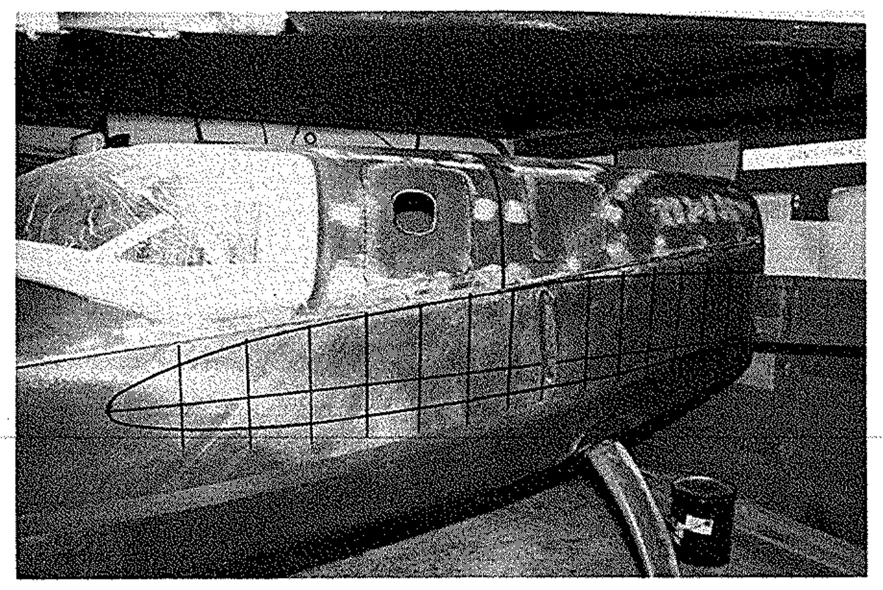
468. Forward canopy opening line transferred to inside VIA 1/16" holes drilled from outside.

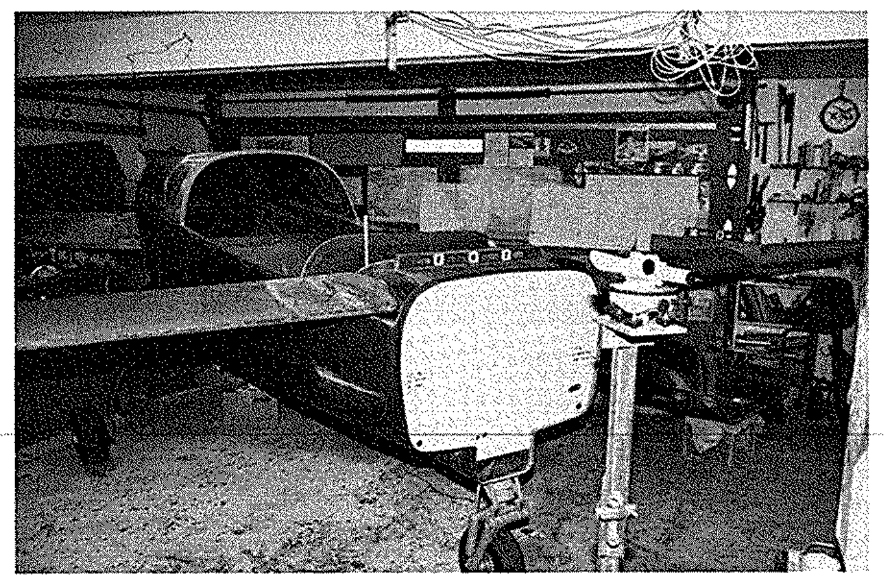
469. Apply added foam strips at rear canopy opening line as shown on D-49.

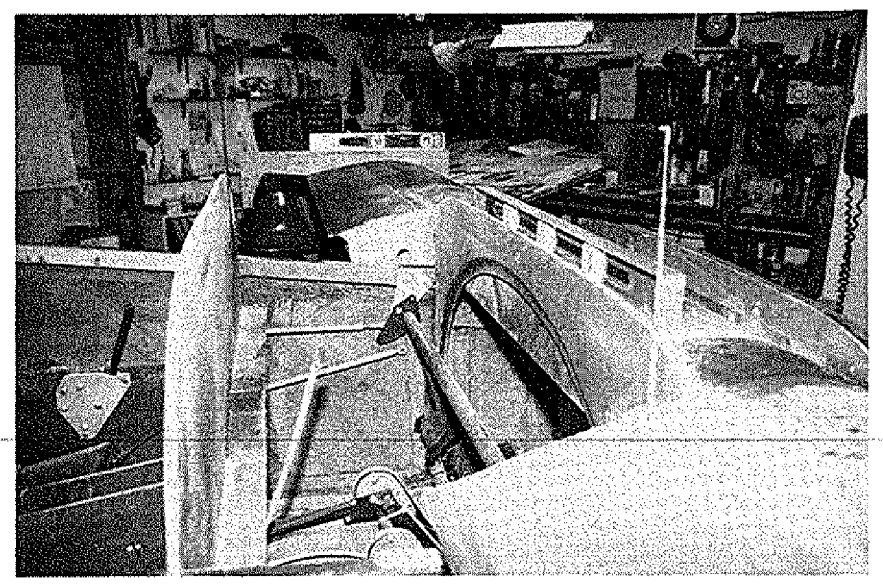

470. ADD plywood inserts and 1 x .049 aluminum cross tube.

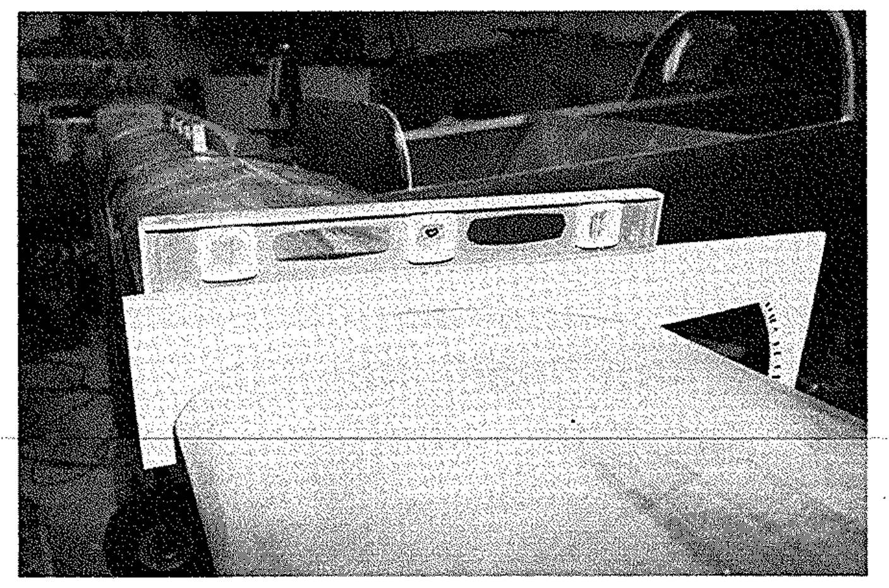

471. Outline of added foam strips D-49.

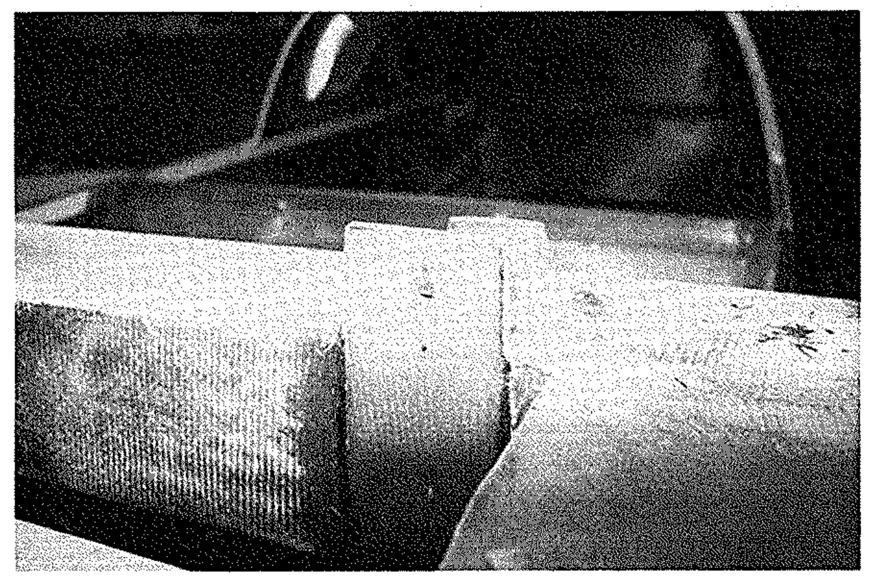

472. Slurry all foam and do layups 7 and 8 and procedures as described on D-50 and D-51.


473. Reinstall turtle deck. MICRO ONLY AFT portion of turtle deck. F.S.130 to 180. Cut canopy loose and remove.

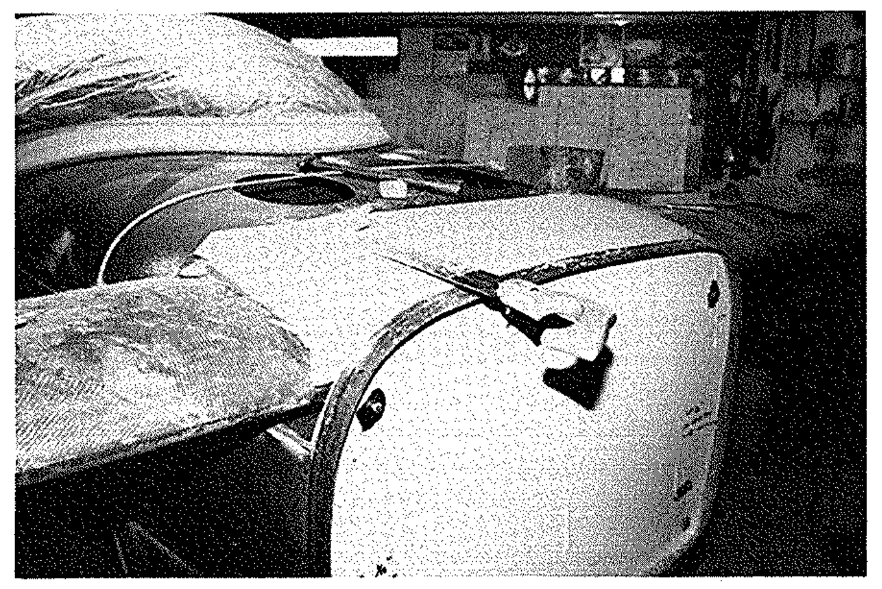

474. Complete details for canopy and opening ledges shown on D-50. Very carefully level fuselage in all directions and set canard in place.

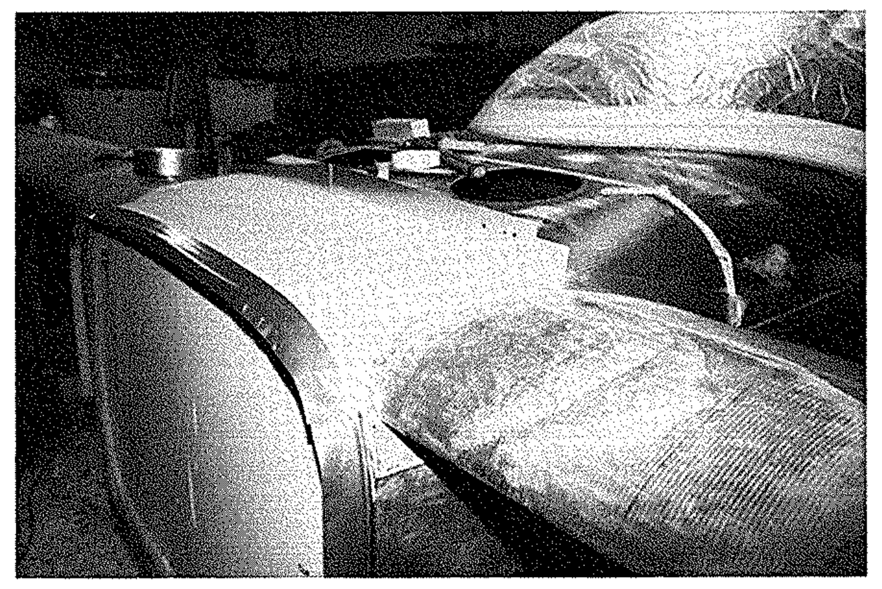

475. Using transit and carpenters level, set canard at proper water line and angle of attack. See canard level and elevator travel jig on Page D-6 and level details on D-50 and D-26.

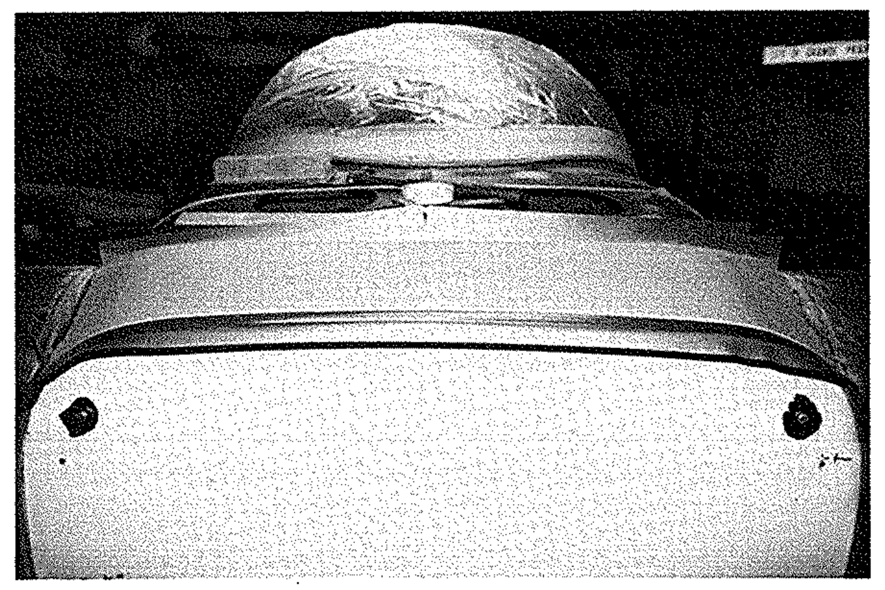

476. Elevator travel and canard level jig (D-6).

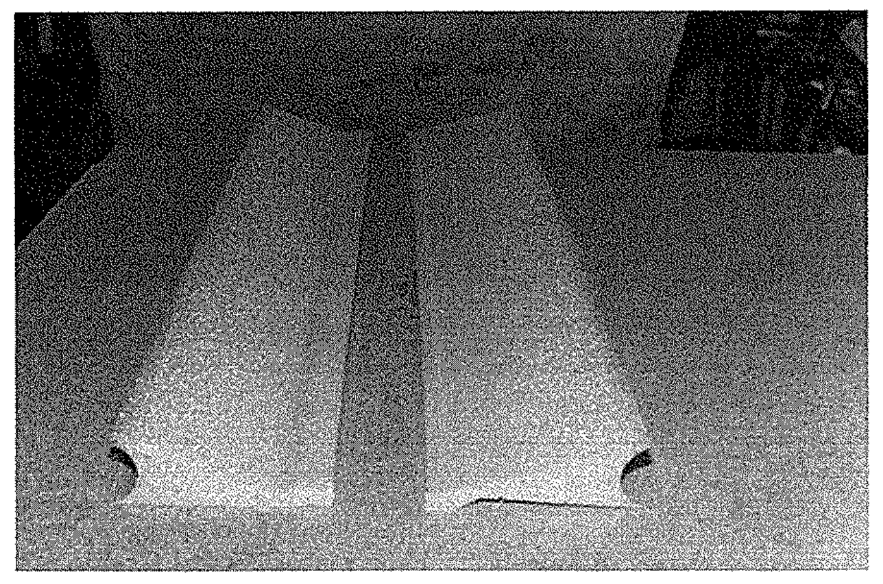

477. Aft lift tab on canard after boring to 5/8" hole. (SEE details D-25, D-26 and D-50).

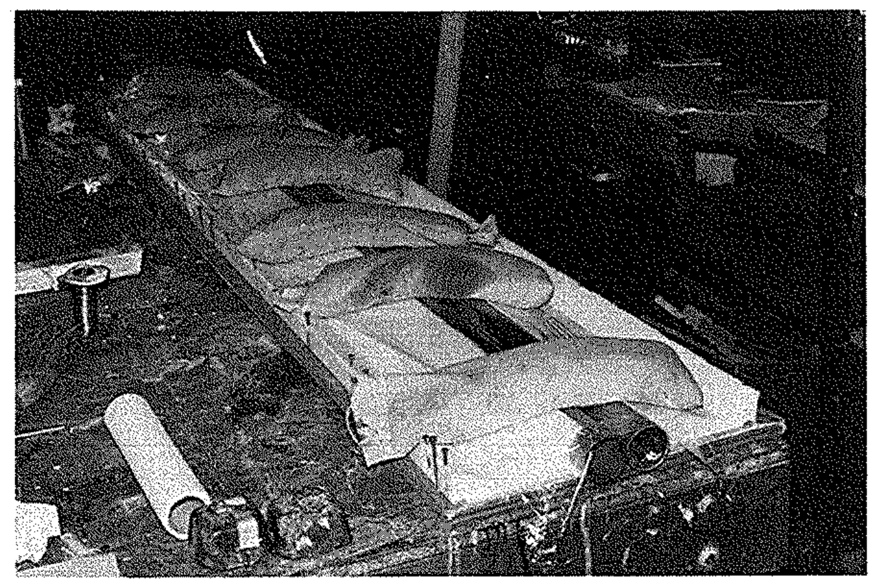
478. Canard forward lift tab before shaping.

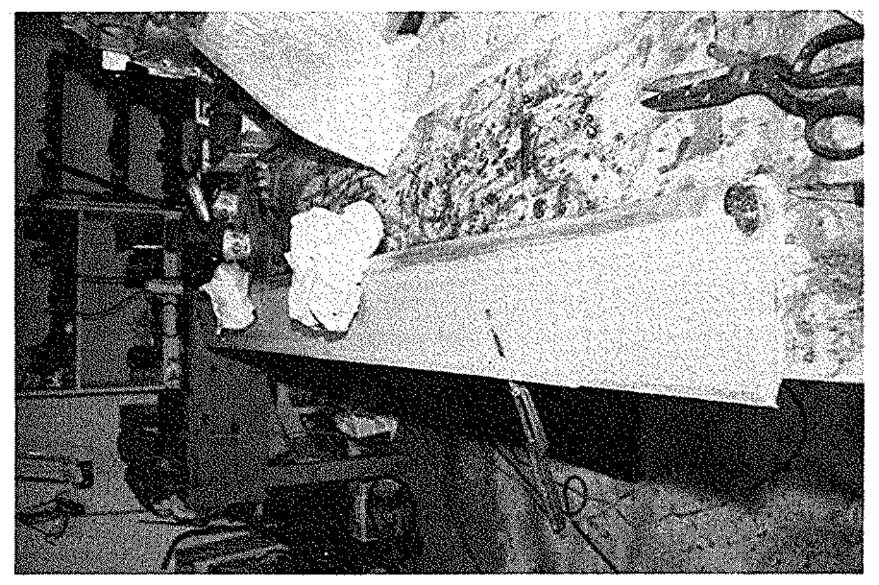

479. Fill in area above canard (after canard has been drilled and attached to fuselage) with X-40 Pour in Place foam and shape. Protect related areas with grey tape as shown in Photo #480.

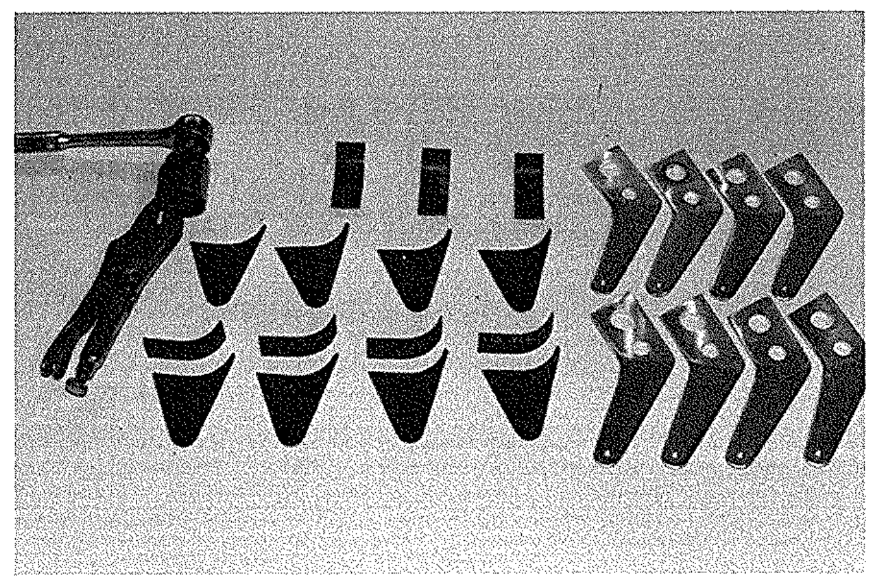

480. Contour foam into smooth flowing lines of turtle deck.

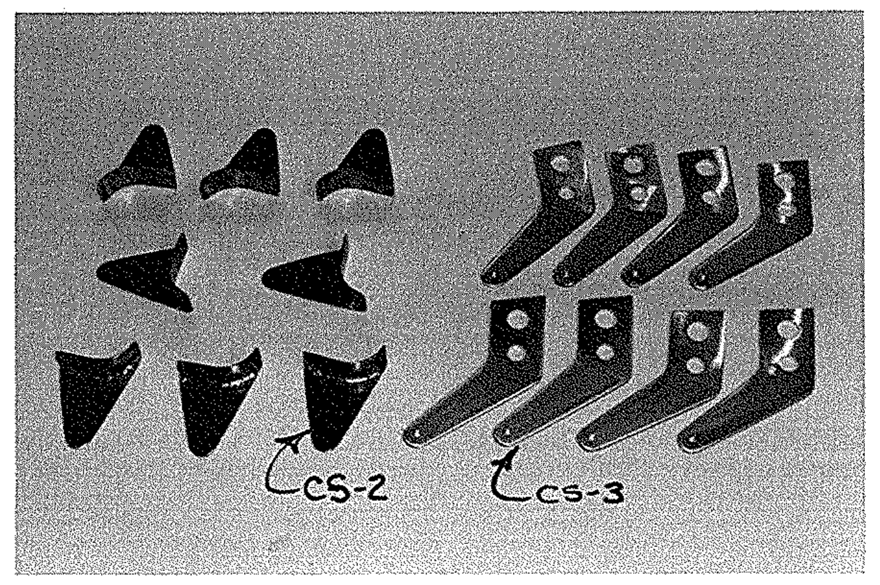

481. With related area protected glass fairing with 2 PLIES of BID at 45°. (SEE D-26).


482. Elevator foam cores. (SEE D-2, D-24, D-25 and D-26).

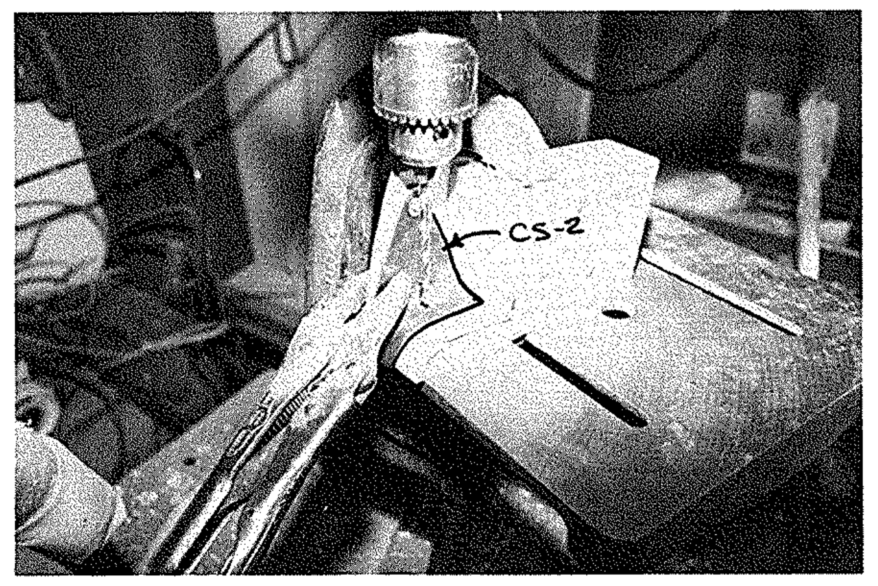

483. Micro CS-1 to elevator cores.


484. Do bottom layup on elevator 2 PLIES UND ± 45°. (SEE D-24).

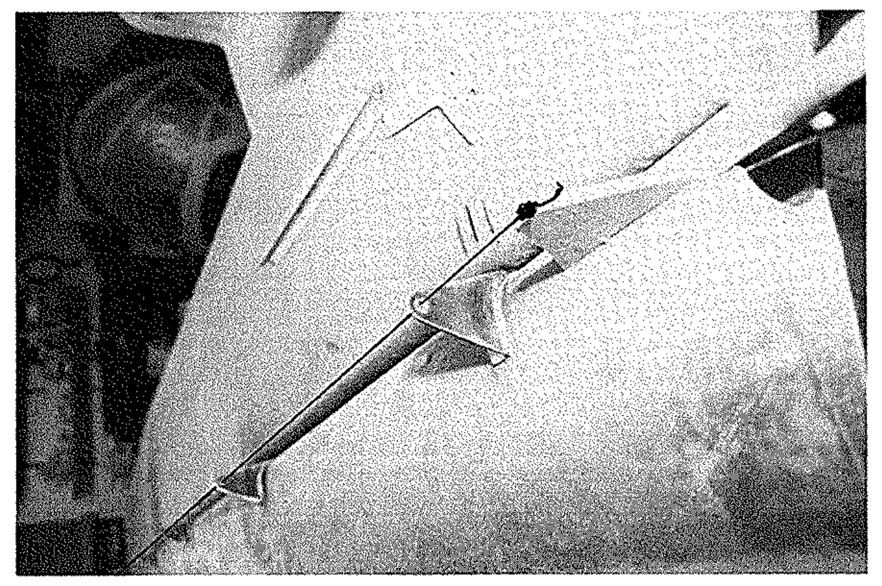

485. Elevator hinge parts.



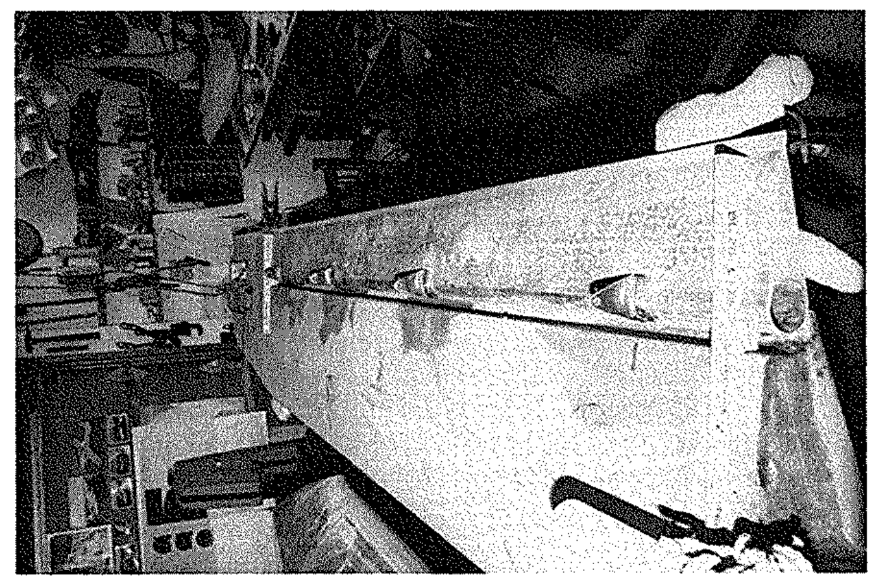
486. Elevator hinge parts.



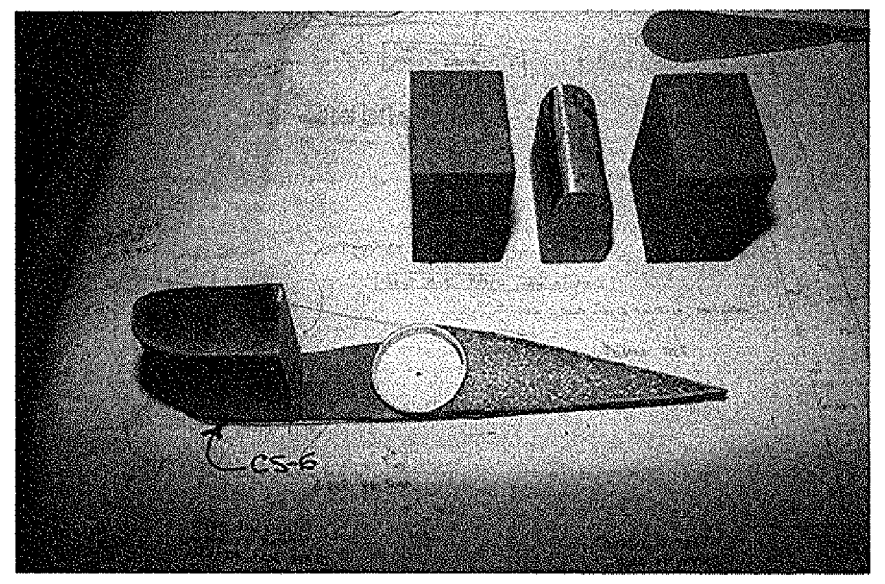
487. Fixture to hold CS-2 to drill required holes.


488. See mounting details on D-27 for CS-2 (8 places). Flox into place in addition to ANS25 screw and rivets. Carefully align with string as shown.

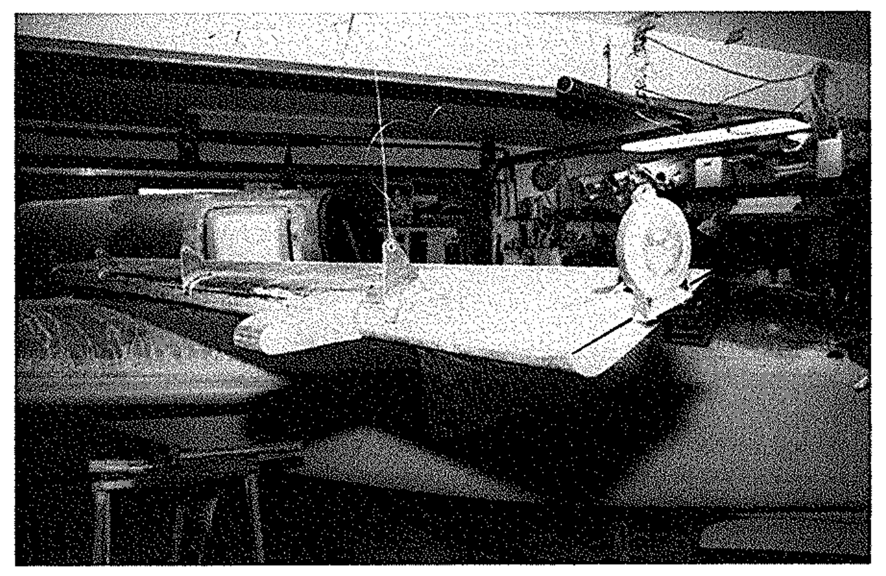
489. Using elevator to canard jigs (D-2), bondo elevator to canard VIA jig.

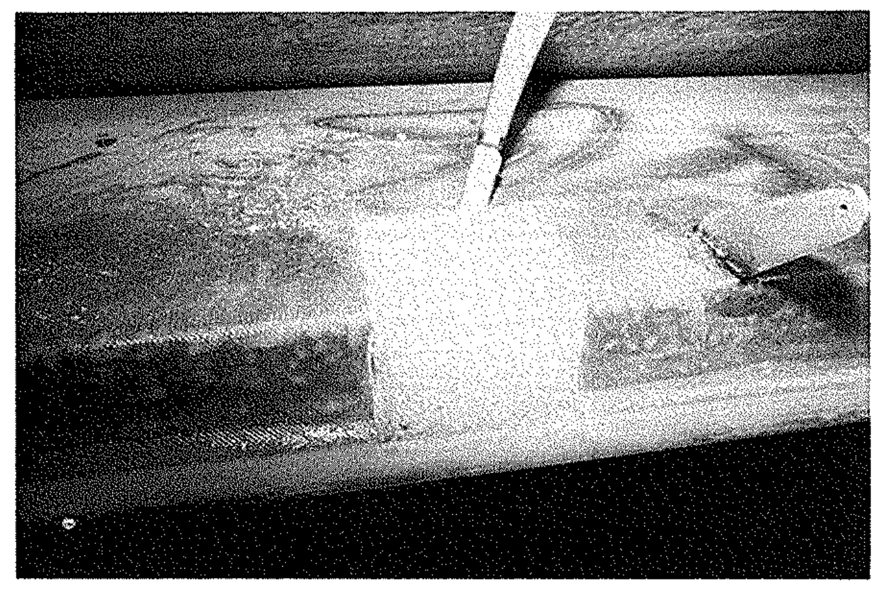

490. Elevator held in place using jigs.

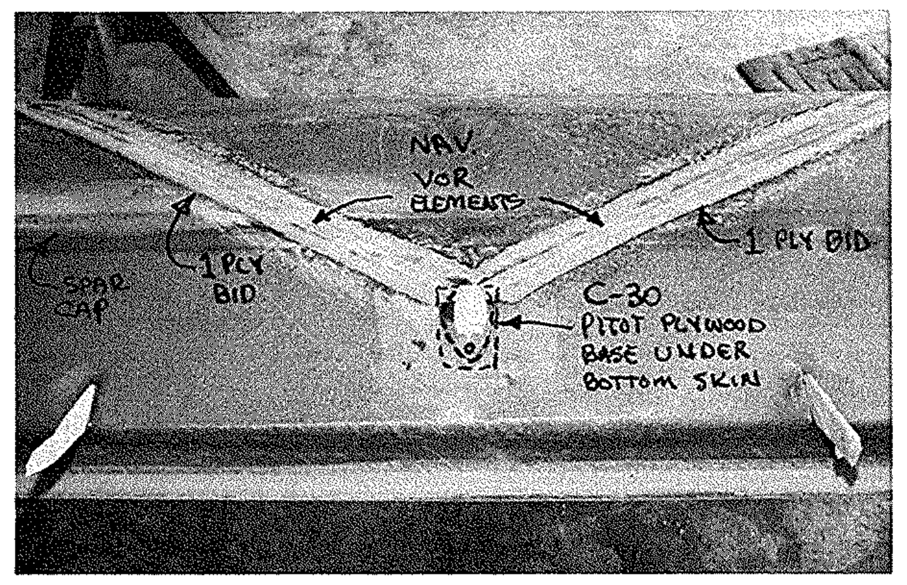
491. Making elevator counter balance weights. (SEE D-24). NOTE: Used old lead telephone splice sleeve as source for lead.



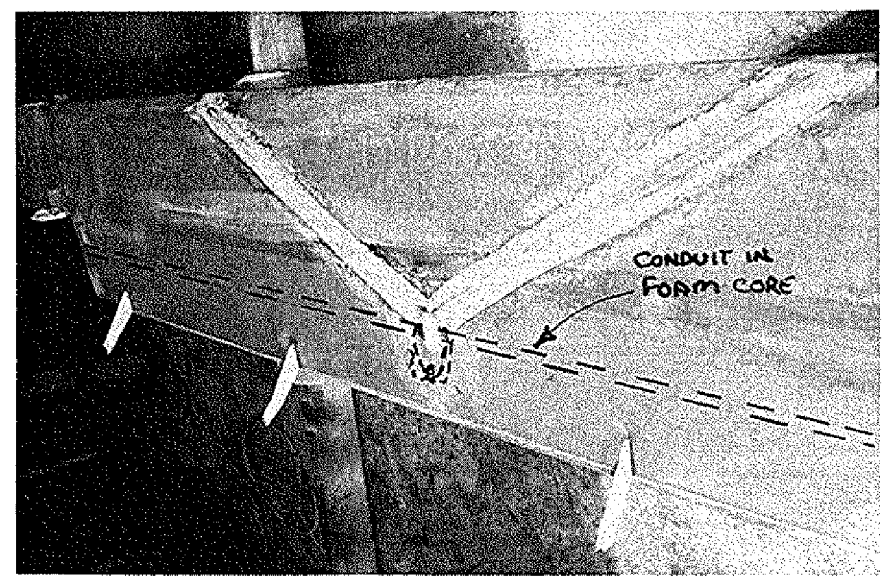
492. Layout of lead weight CS-6 and cross section of elevator.


493. Hanging elevator to check counter balance limits. (SEE D-27). Check each elevator after construction to see if you're in limits but definately check after painting and correct if out of limits.

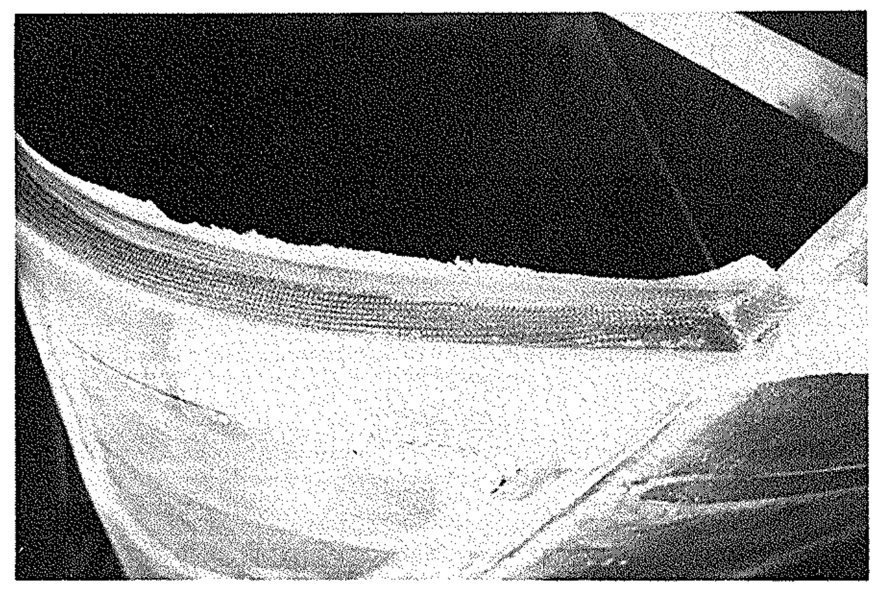

494. Cutting out area in canard for elevator counter balance weight CS-6. Glass with 1 PLY BID at 45°. (SEE D-24).



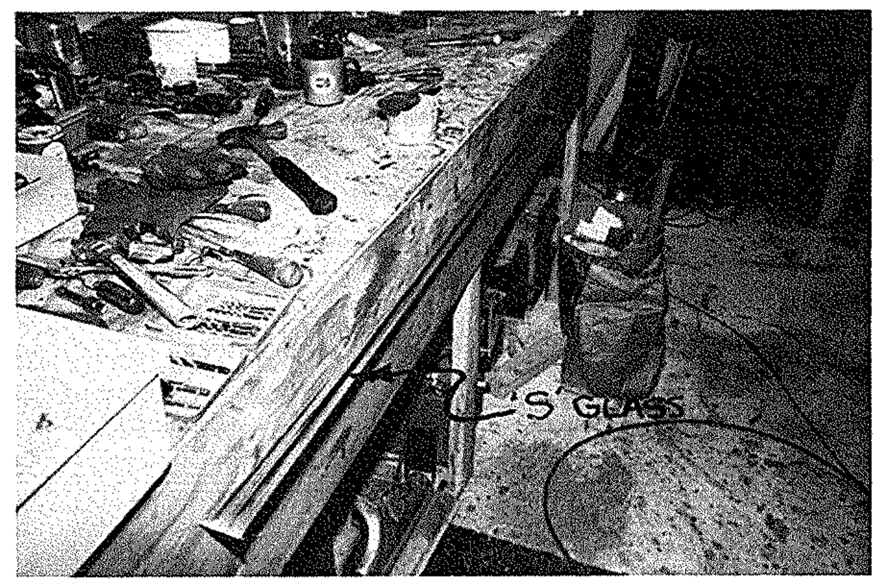
495. Install NAV antenna. 2 each 1/2" wide x 24" long copper foil attached to bottom canard skin (BL-65 LEFT SIDE). Cover each element with 1 PLY BID TAPE. (SEE D-27).



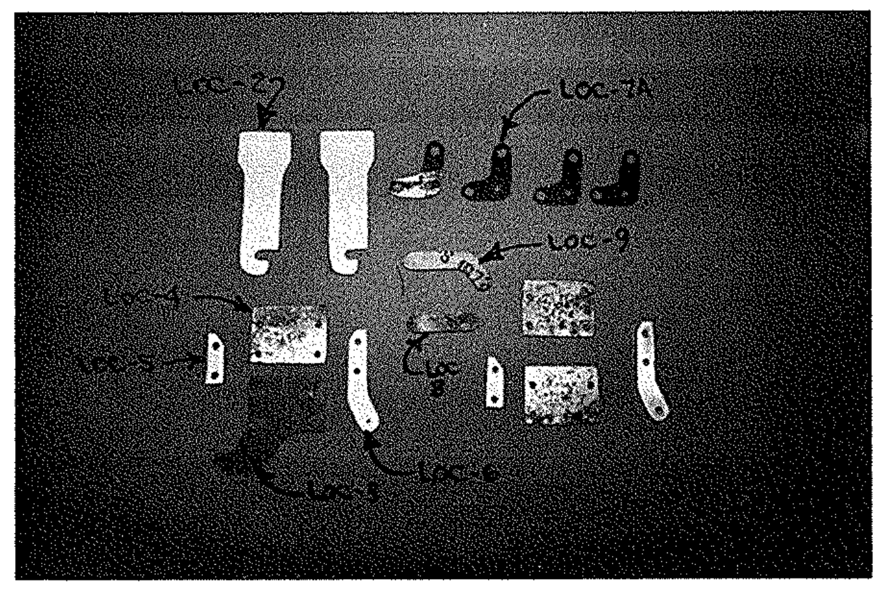
496. At base of 'V' of antenna under canard skin is a plywood base with anchor nuts to hold Piper style pitot and static unit.


497. Lip on turtle deck at rear canopy opening edge.

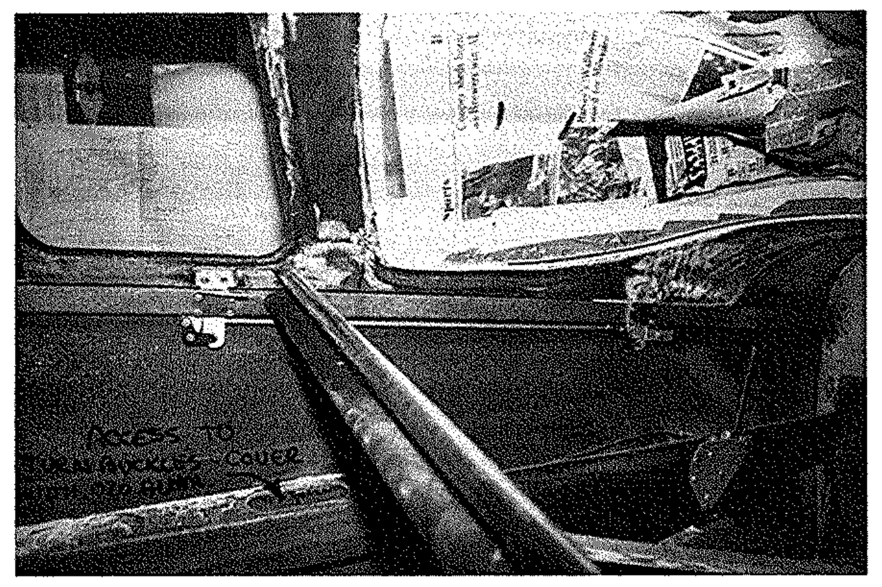
498. Place 'S' glass around edges of canopy. (SEE D-50).



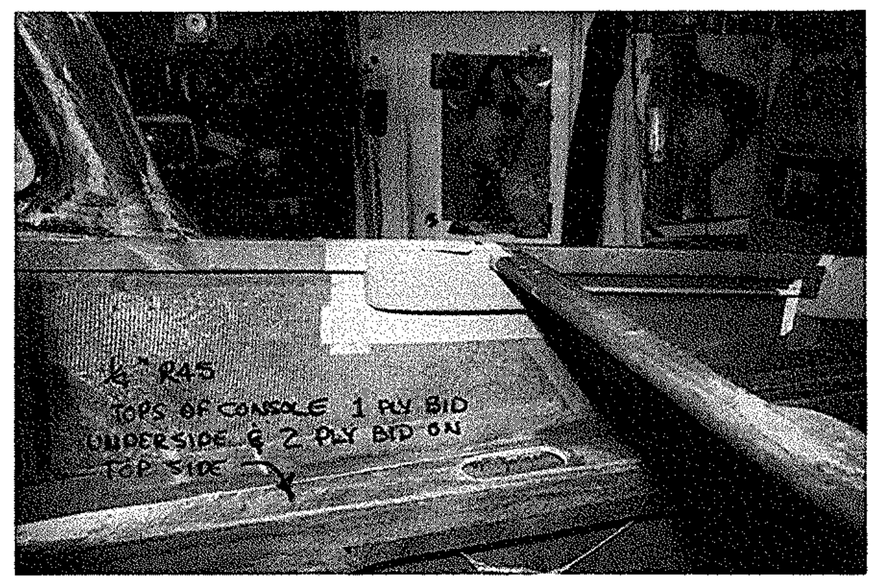
499. Quick way to make 'S' glass "rope" for around canopy is to string between two nails and wet with epoxy and brush.



500. Parts of canopy latch system.

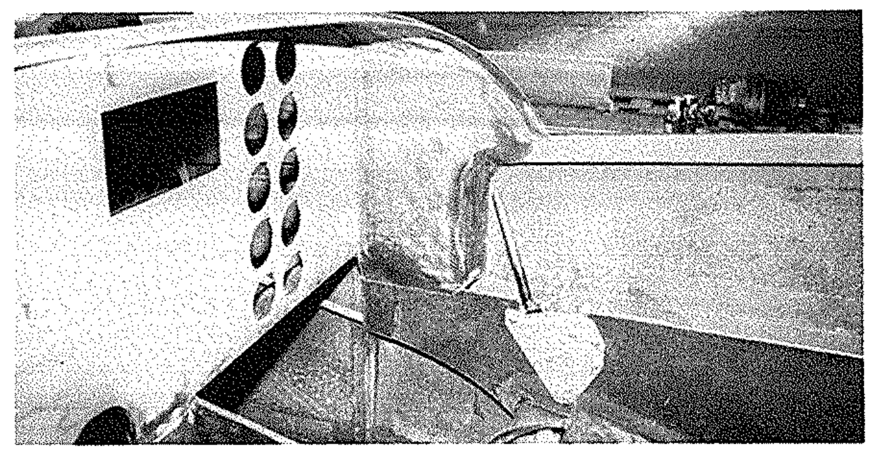


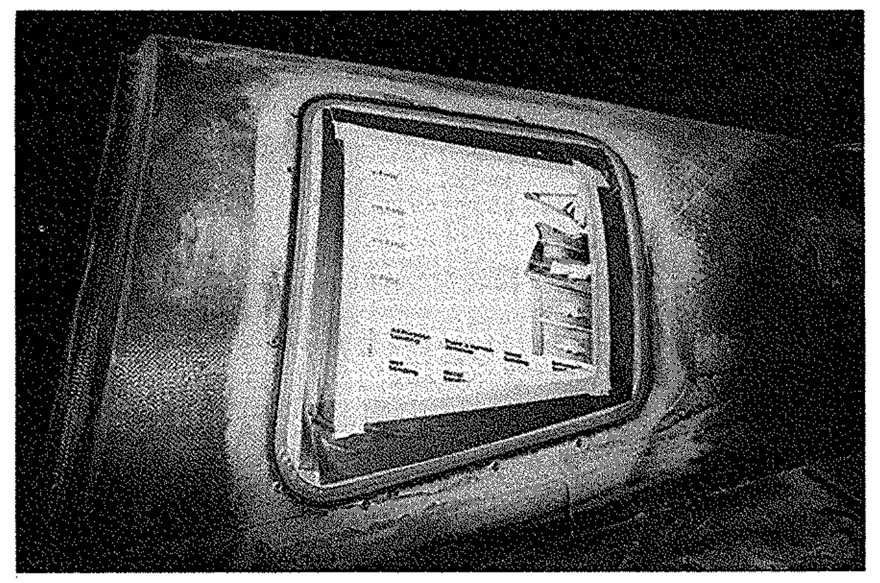
501. Latch mechanisms (canopy).



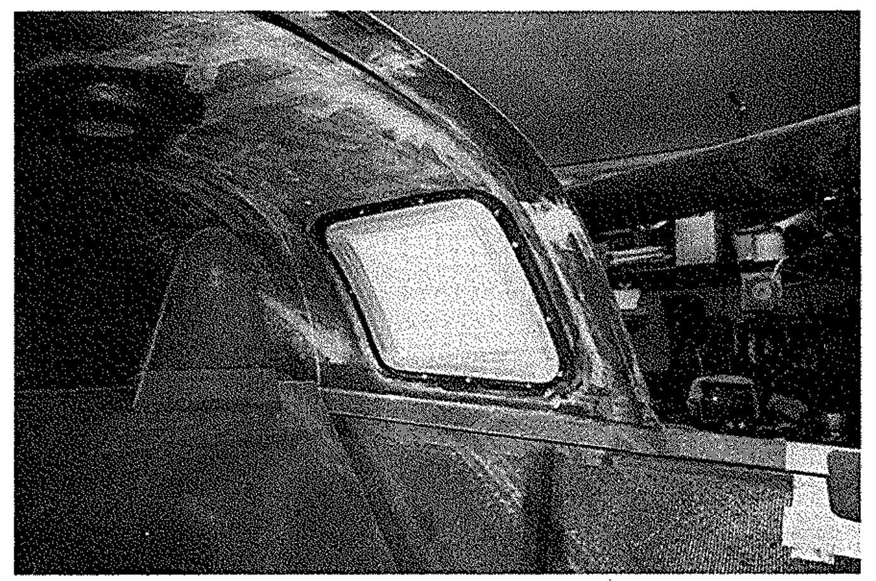
502. Lay urethane foam over latches, form to shape and glass 2 PLIES BID at 45°.

503. After 2 plies of BID is cured, remove foam from cover with wire brush. NOTE: Wiring!

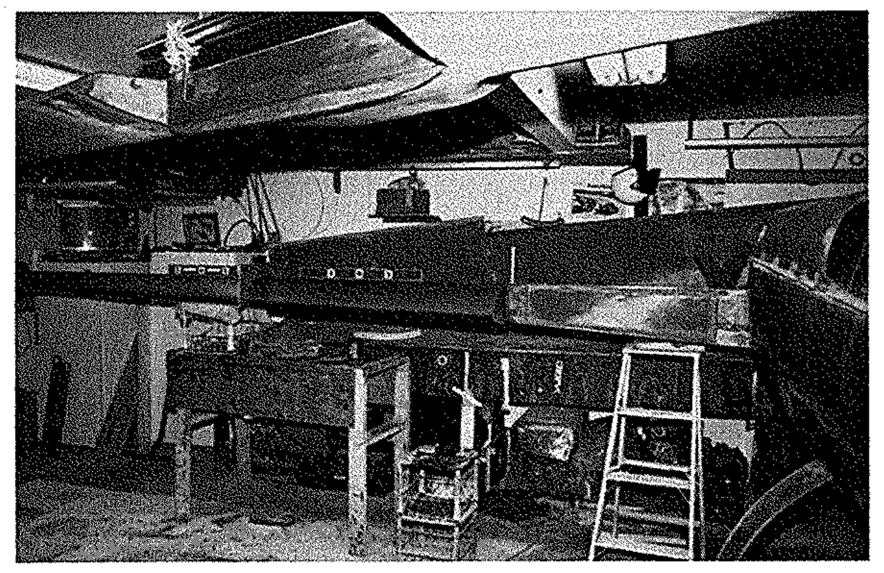

504. Form side corner (left and right) if desired using same method as described in Photo #502 and #503 except use 3 PLIES BID instead of only 2 plies.



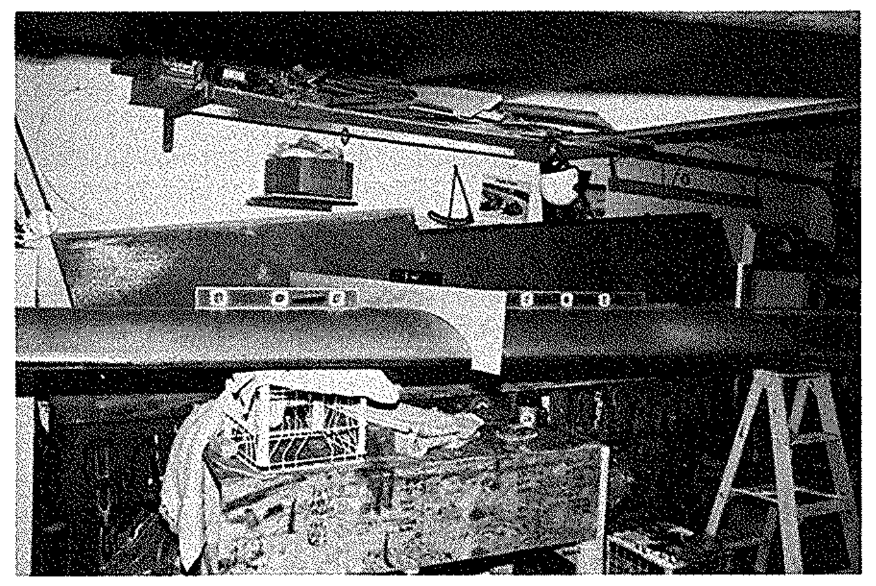
505. See D-54 on how to form 1/8" plexiglass side windows (4 places). Protect both surfaces as shown. Cut each window to shape with 32 tooth band saw. (SEE Section J-J, D-50).



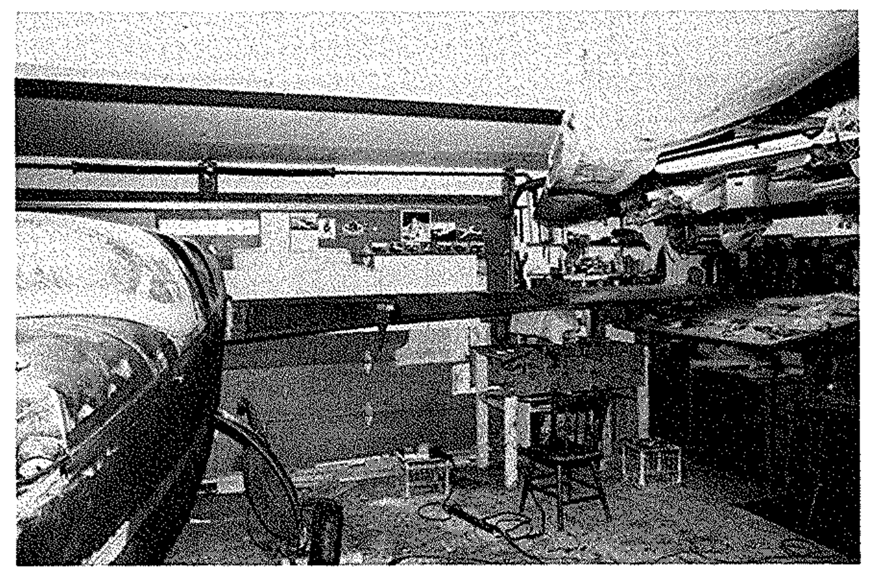
506. Sand edges of glass and wet flox in place. Hold in place (TEMPORARY) with common 1/8" ALUMINUM pop rivets with washers until cured. LAP 1" wide BID at 45° tape around edge of each window on inside after removing all rivets.



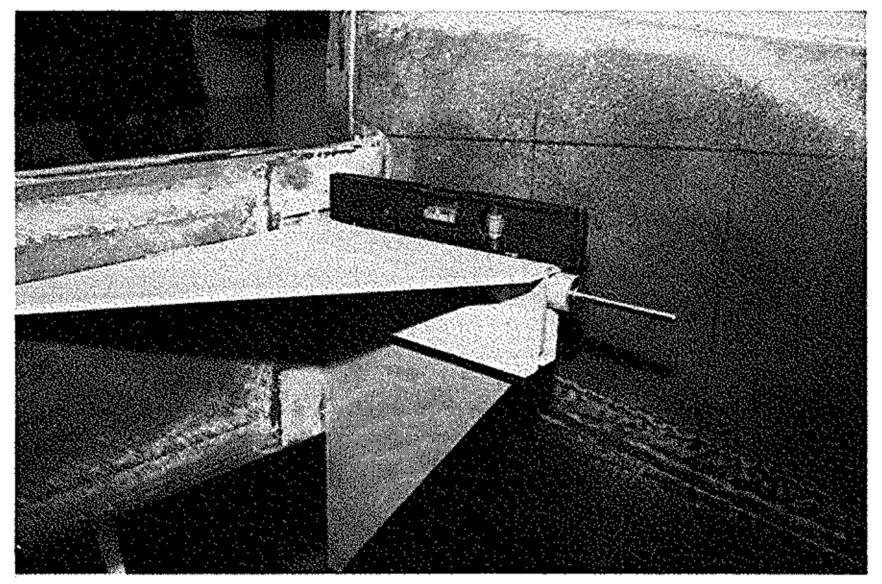
507. Aligning right wing to prepare for drilling wing attach holes. Use transit to level fuselage in all directions and the wing root to tip. Carpenters levels are for double check and for leveling wing incidence. (SEE D-52).



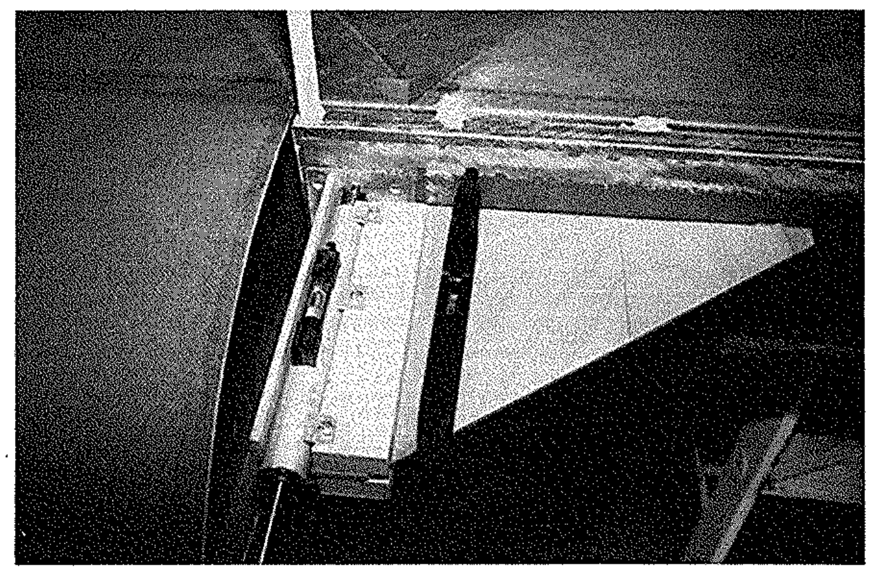
508. Right Wing. Double checking wing level and setting angle of attach (incidence).



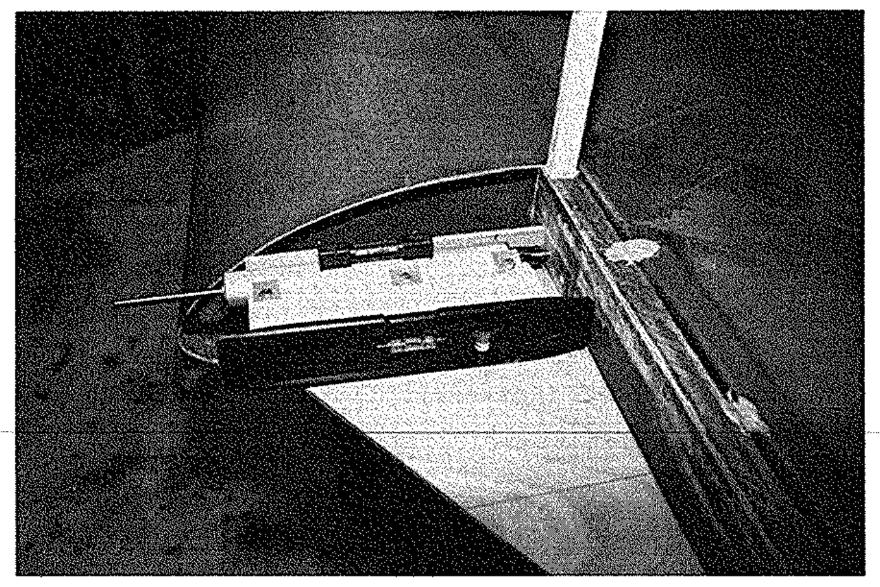
509. LEFT Wing. With small work shop or garage it may be necessary to do only one wing at a time. This is why the transit (or Dumpy Level) is so necessary and much more accurate than the carpenters hand level.



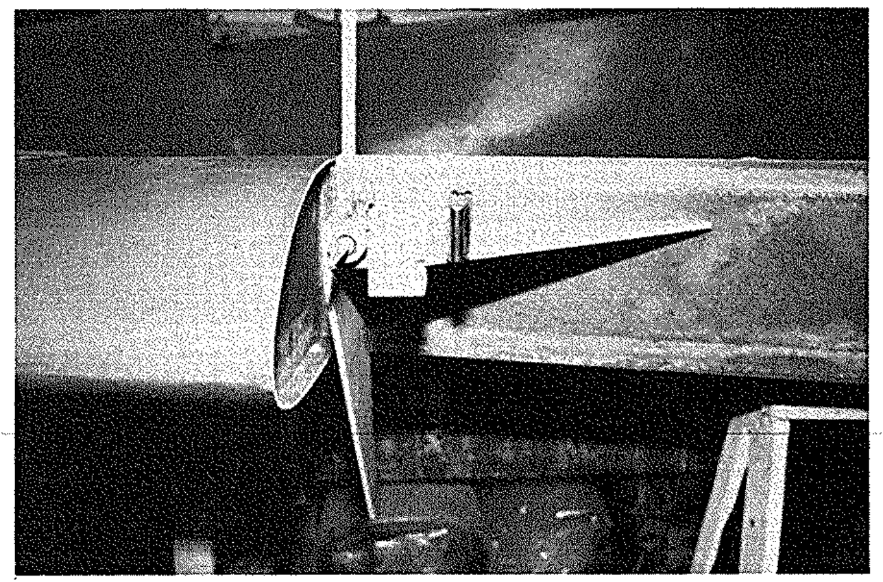
510. Very carefully study and locate position of spar caps. (DO NOT DRILL THROUGH SPAR CAP UNDER ANY CIRCUMSTANCES). SEE D-19, D-28, D-29, D-30, C-31, D-52 and D-56.



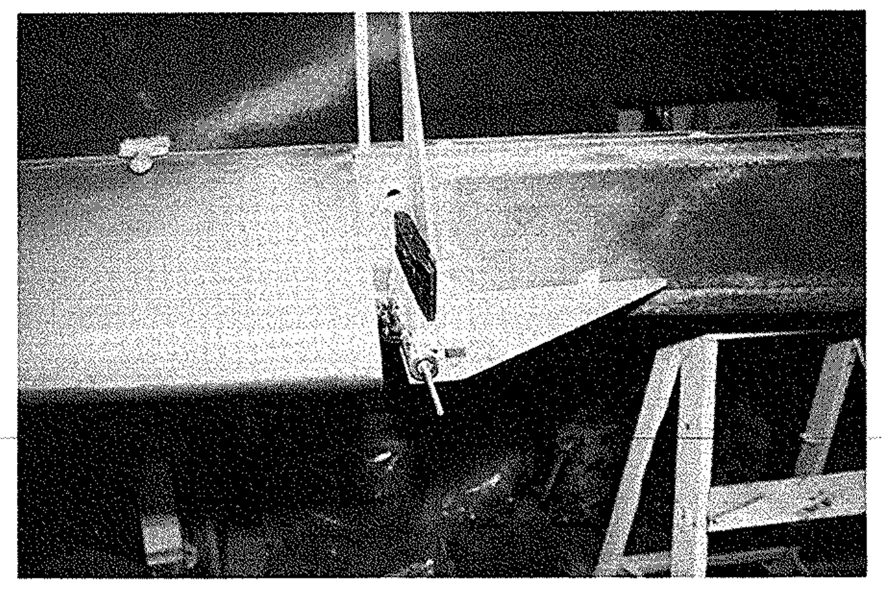
511. Right Wing. Before attaching jig and after careful alignment of patterns 'A' or 'B' (D-52) drill each hole 1/4" deep to identify hole locations. Note wing has been squared off to 90° from spar. SEE D-32.



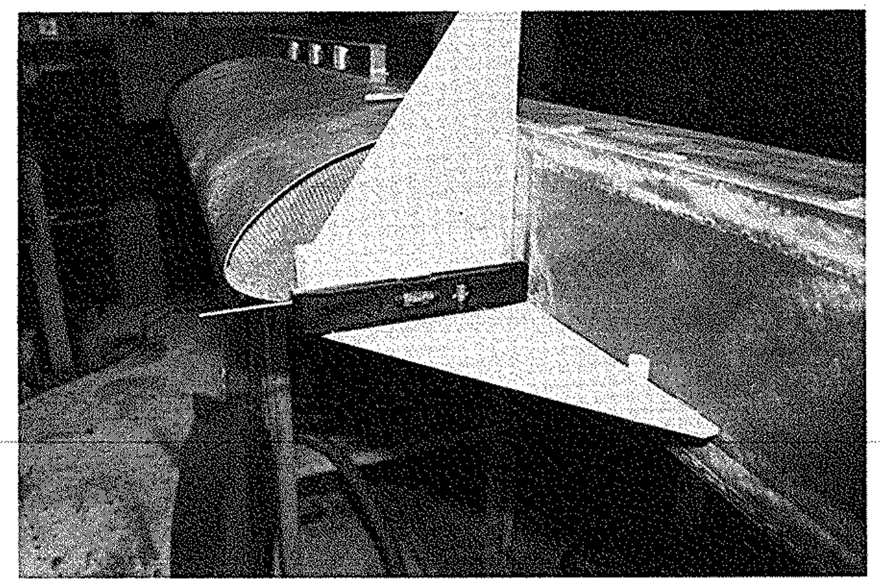
512. Right Wing. Note bondo holding wing to centersection spar. Support wing in other locations as shown in photos.



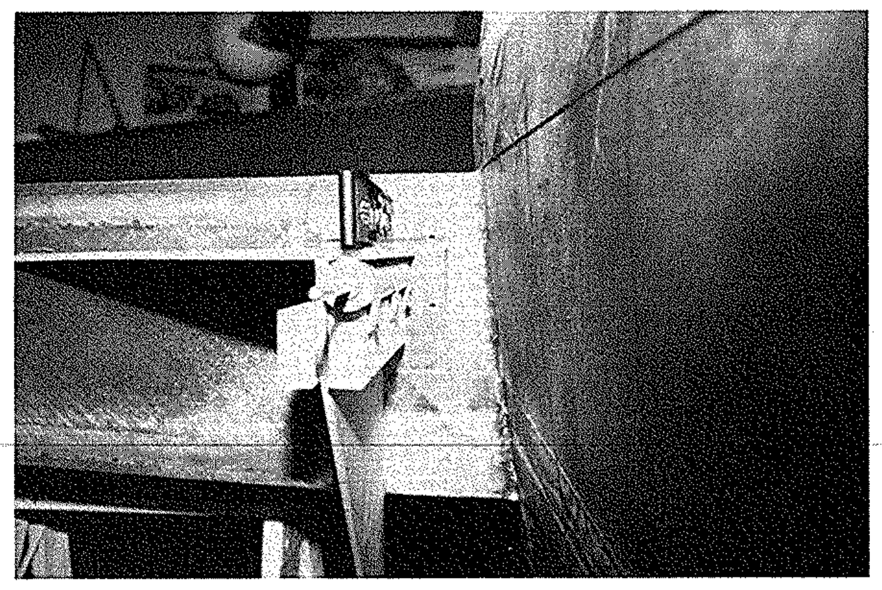
513. Right Wing. Tack (HOT GLUE) jig to centersection spar after leveling and aligning such. Once in place apply required bondo or hot glue to hold.



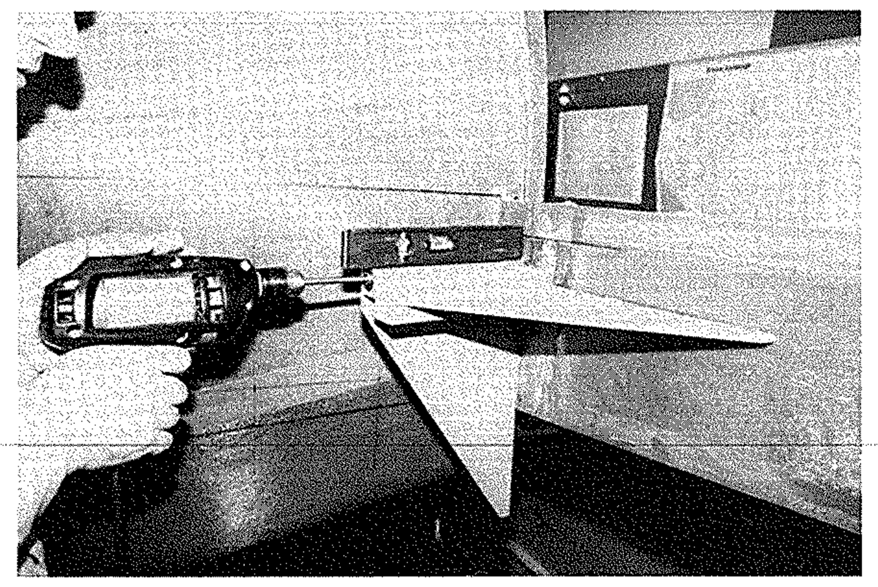
514. Right Wing. Use a long 1/4" (bell hanger bit) to act as pilot to attach jig and proceed to drill 1/4" hole through centersection spar and wing spar. (Next photo continues).



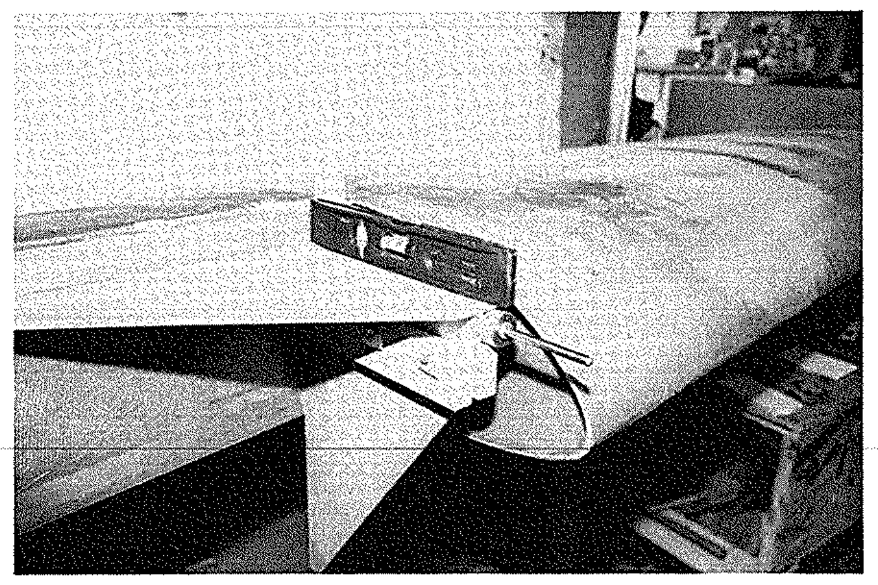
515. Right Wing. Once 1/4" hole is drilled removed bit guide tube from jig and replace 1/4" bit with 5/8" spot face bore, reinstall guide tube in undisturbed jig. Bore 5/8" hole as required.



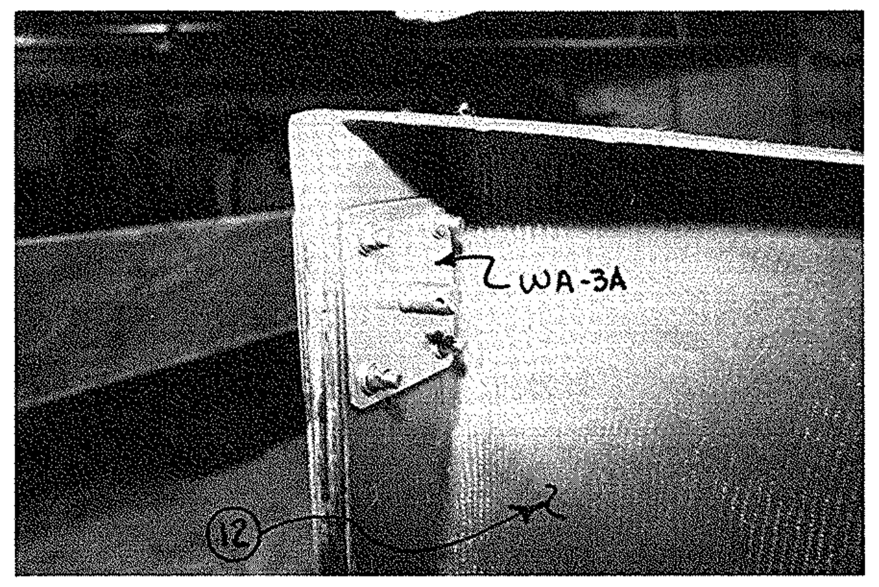
516. Right Wing. Setting up jig on inboard attach point.



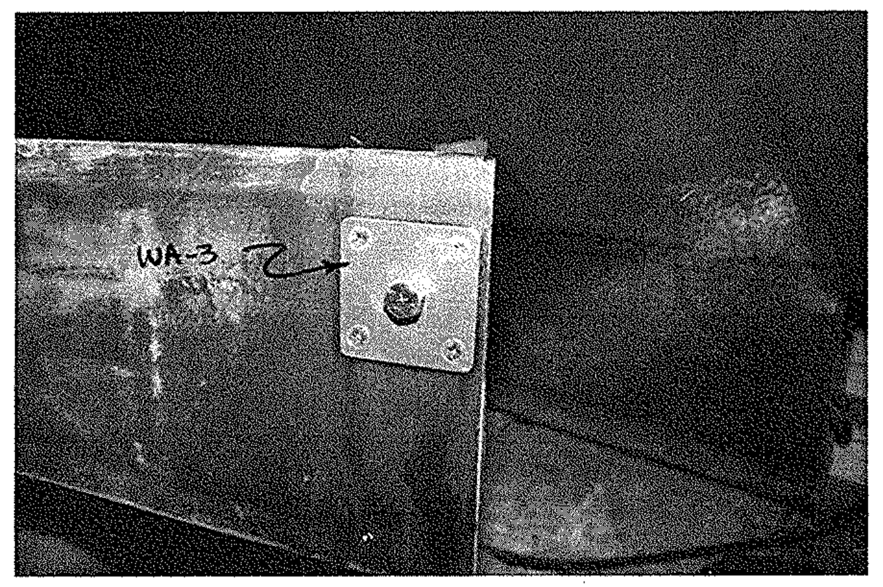
517. LEFT Wing. INBORAD ATTACH POINT. Carefully support drill motor to eliminate any unwanted strain on jig.



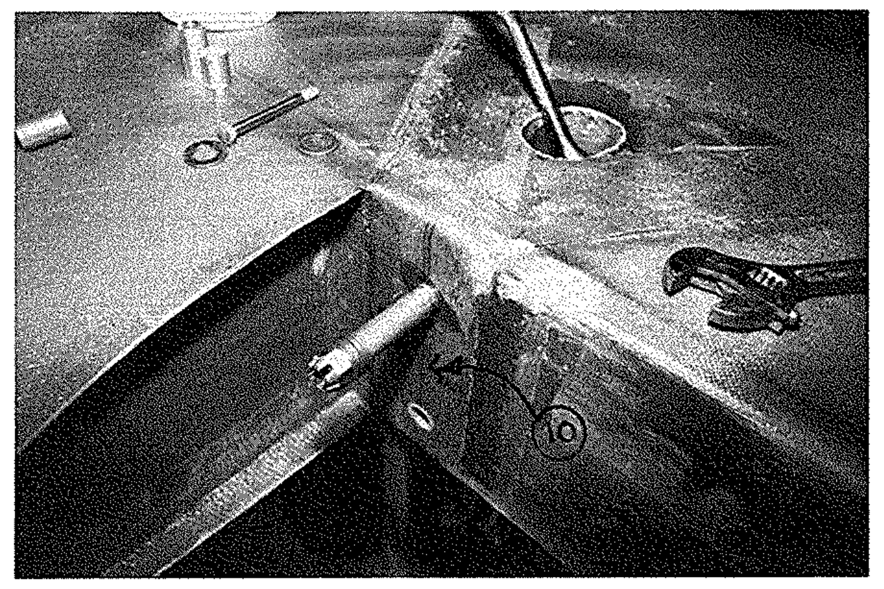
518. LEFT Wing. OUTBOARD ATTACH POINT. Always monitor the level and alignment during complete operation. Take your time, don't rush now.



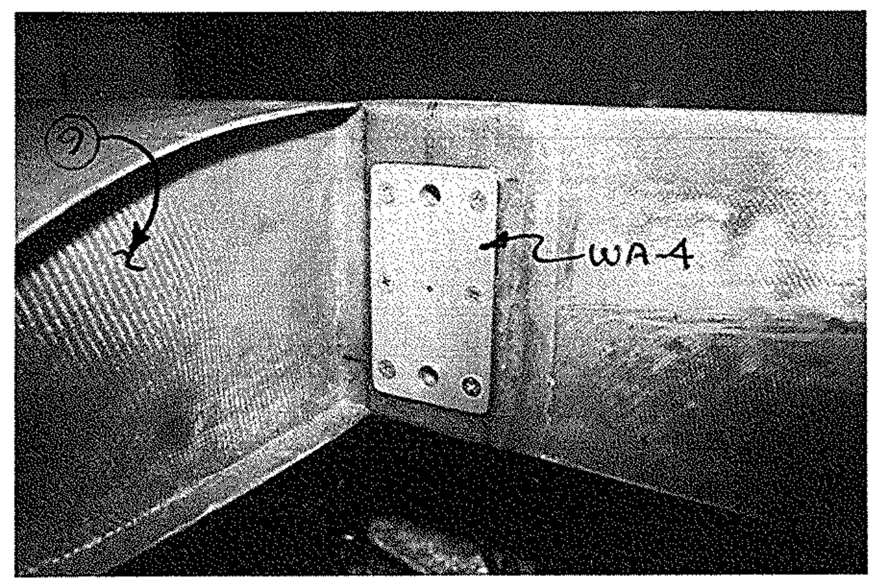
519. Right Wing. Inboard attach point after installing WA-3A. (SEE D-29).



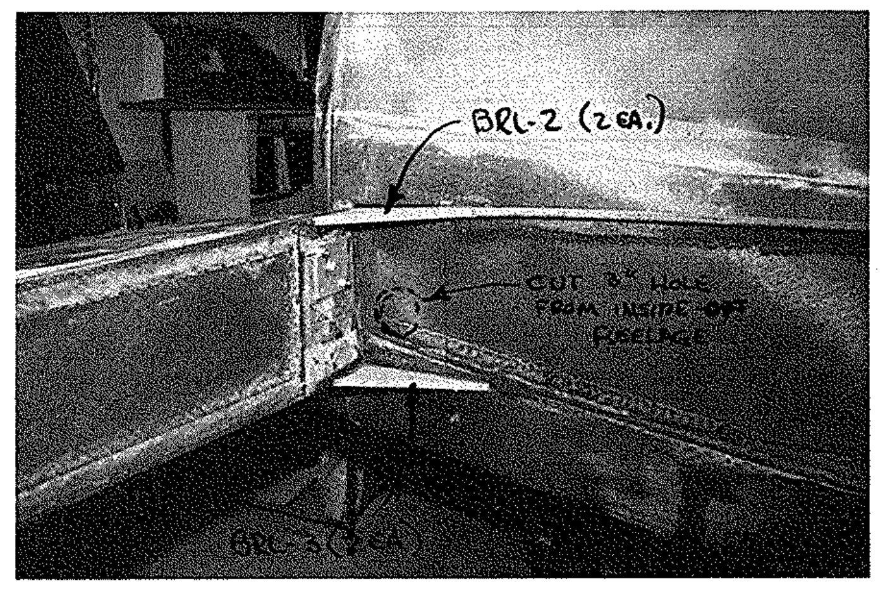
520. Right Wing. Inboard attach point, front face after installing WA-3. (SEE D-29).



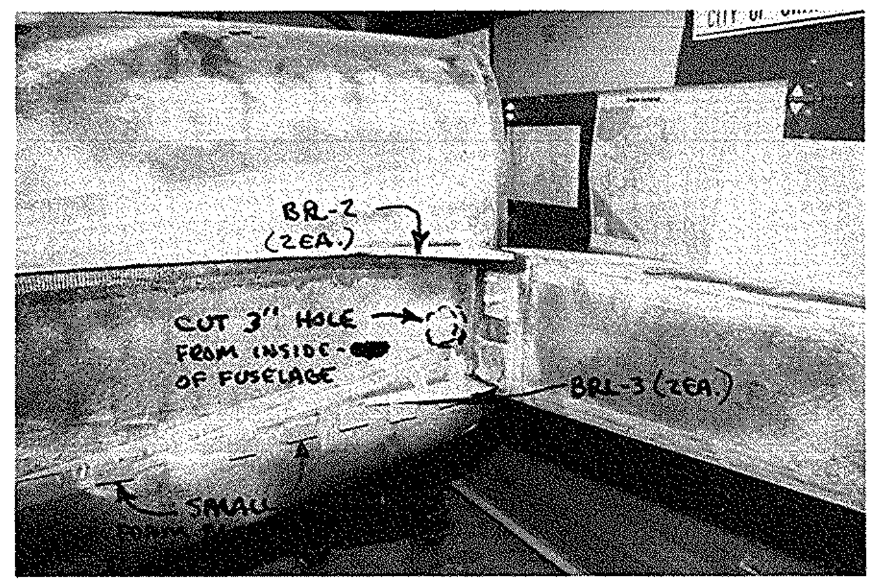
521. Right Wing. Installing aluminum spacer on Defiant #002. Plans have been changed to show WA-6 being placed after installing WA-4. Study D-29, D-30 and D-52.



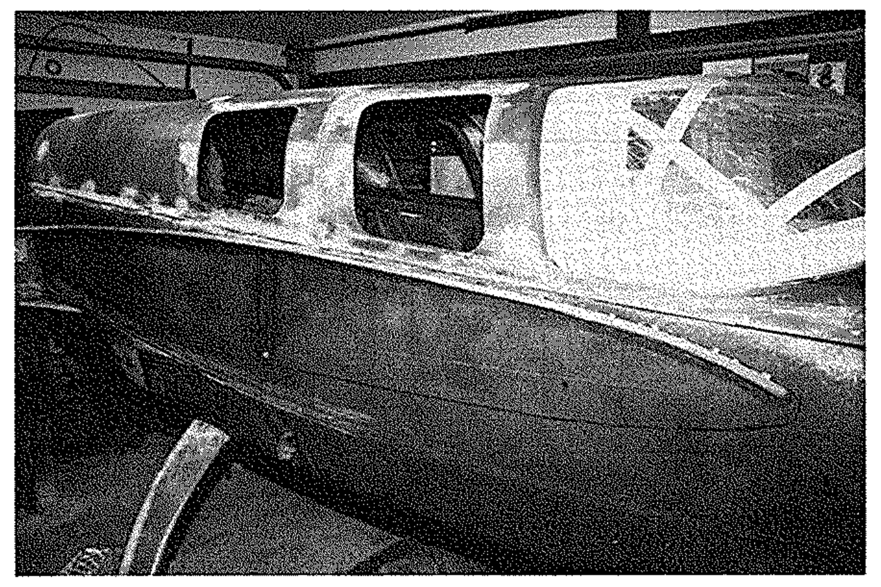
522. Right Wing. Outboard attach point after installing WA-4 and plans change WA-6. Note end rib layup ⑨.



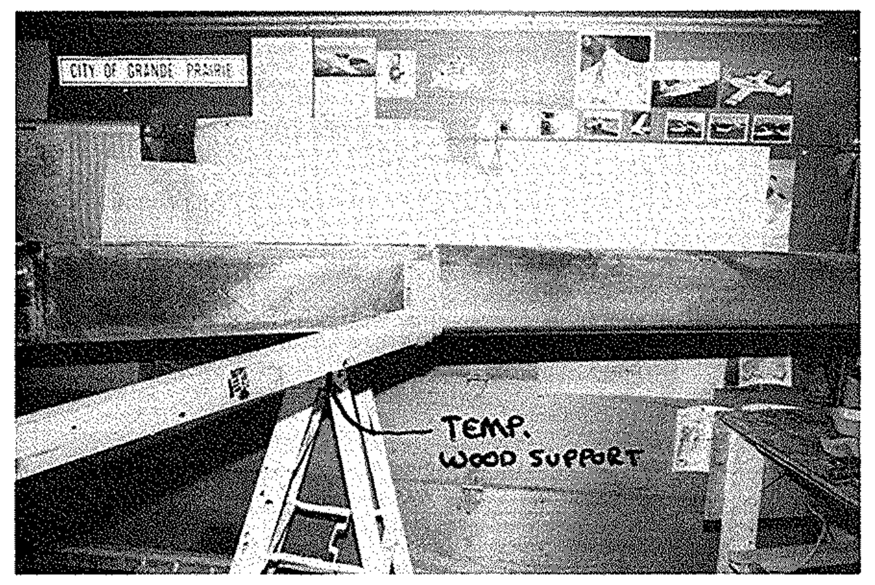
523. RIGHT SIDE OF FUSELAGE. Layout fuel tank lines. (SEE D-54) and Photo #473. Install BRL2 and BRL3. (SEE D-55).



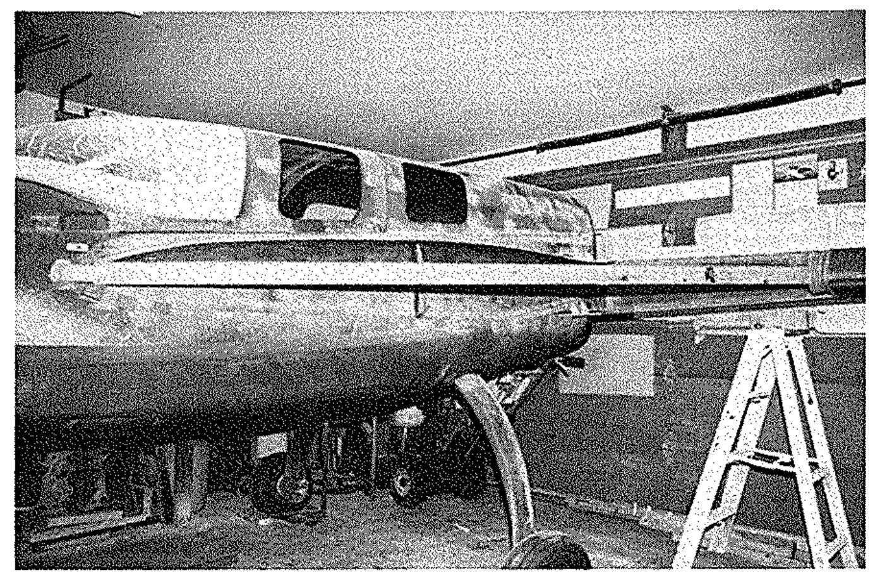
524. LEFT Side. Study Photos #560 and #562 on page C-14 and cut 3" hole in fuselage sides to have access to wing attach bolts after completion. Cut from inside of fuselage out to save hitting aileron cable conduits.



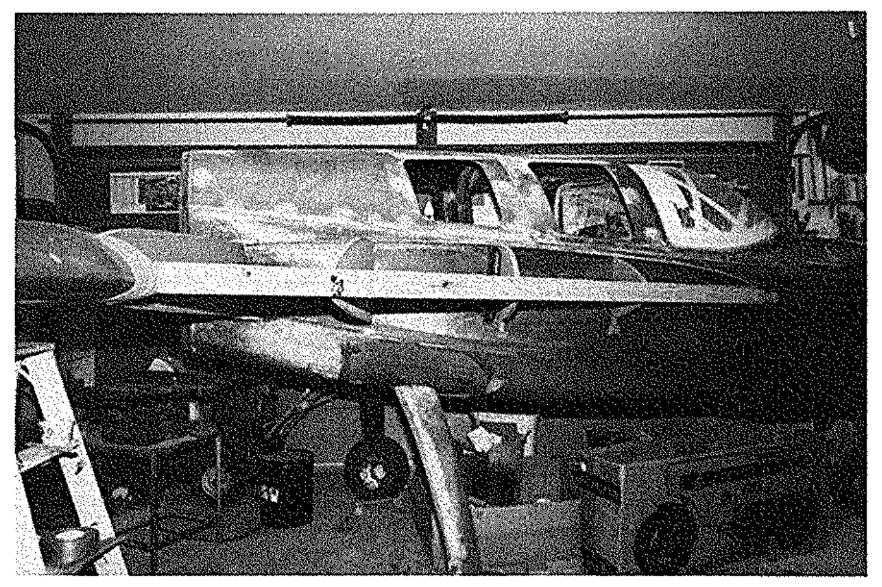
525. Right Side. Attaching temporary foam to fuselage to form layup #1 lip. (SEE D-55). If you did not install fuel sight gauges in tank, here is your last chance.



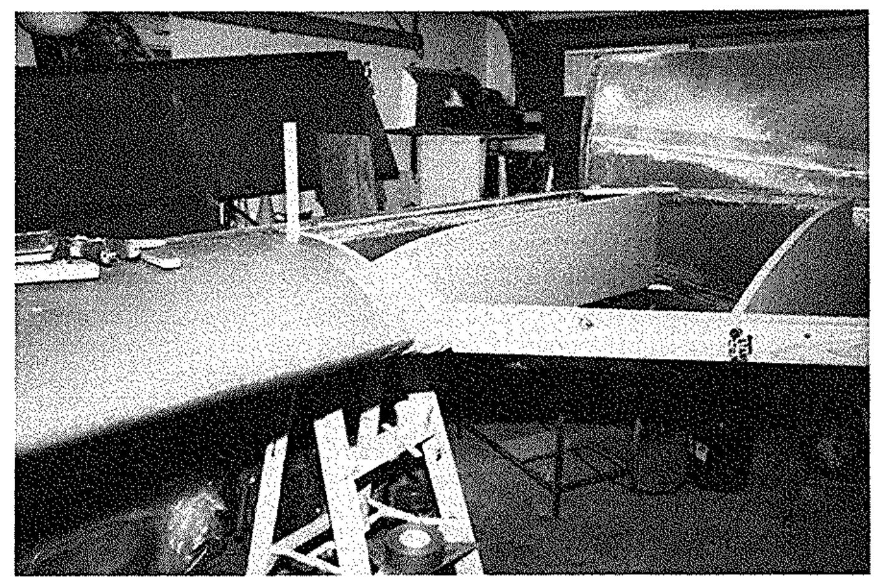
526. LEFT Tank. Study D-55. Section E-E and place temporary wood support with 3/8" foam attached.



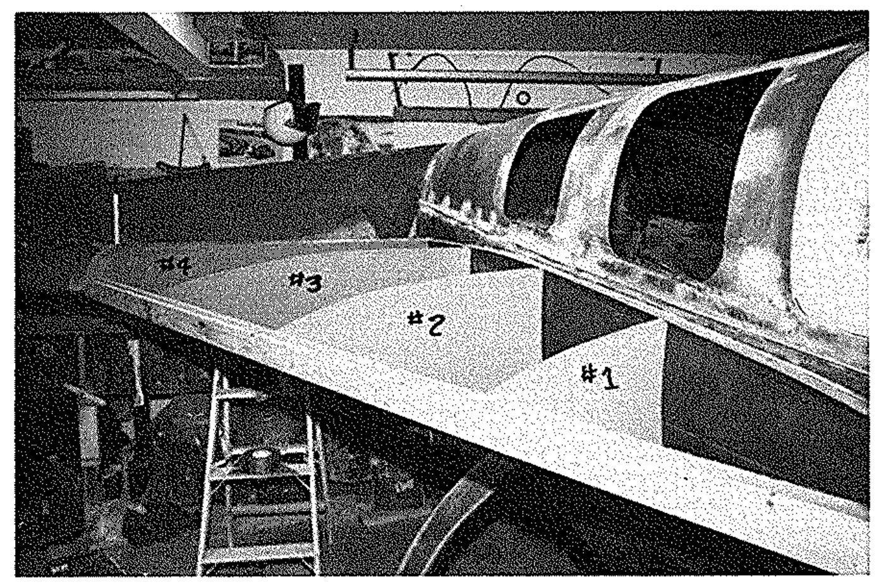
527. LEFT Tank. If you did not install fuel sight gauge, carefully cut fuselage skin and sand foam to shape of gauge (SEE D-34) down to inside skin. Cover with 3 Plies BID at 45° lapping 1" onto fuselage all around gauge.



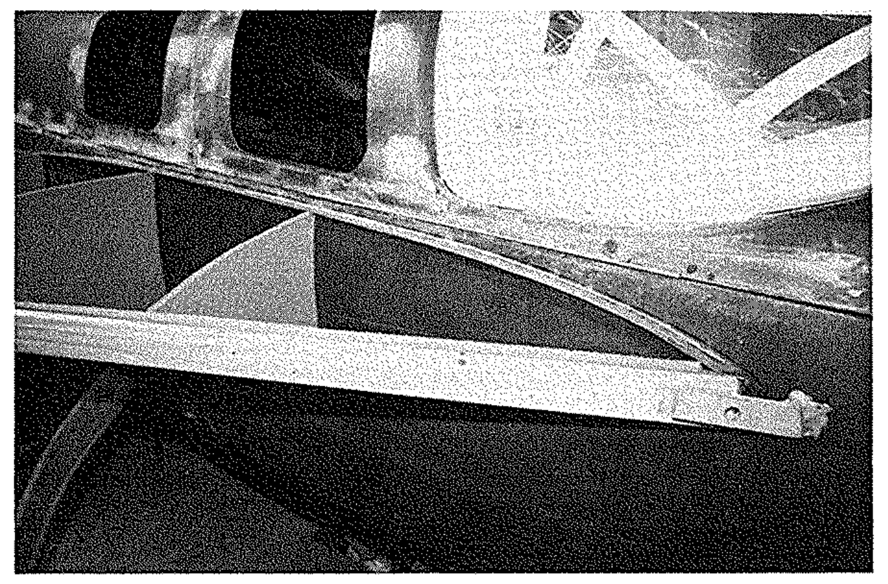
528. Right Tank. Temporarily install ribs 1,2, and 3. Hold in place with nails and small dabs of hot glue. Permanently install Rib #4.



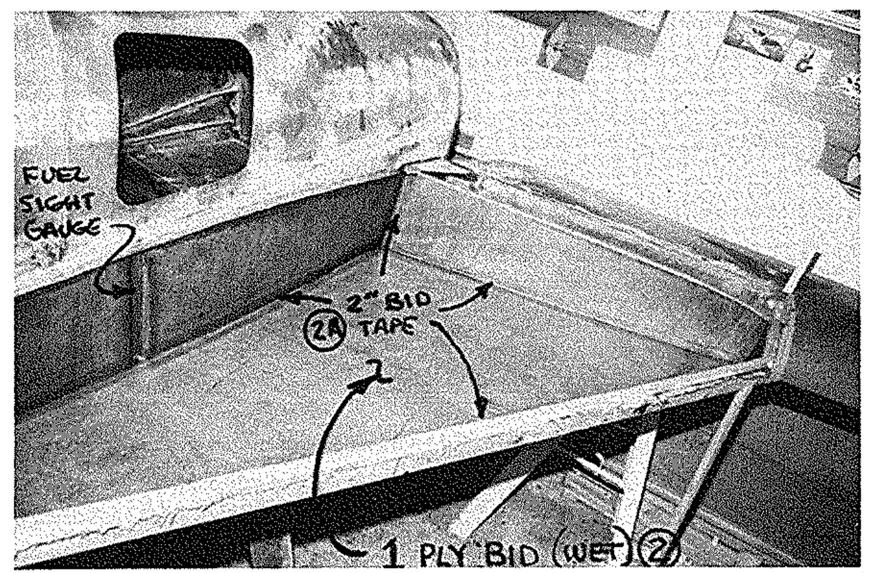
529. Right Tank. NOTE: Rib #4 is aft of fuel tank. Do not run tank to centersection spar, because of C/G limits and wing attachments.



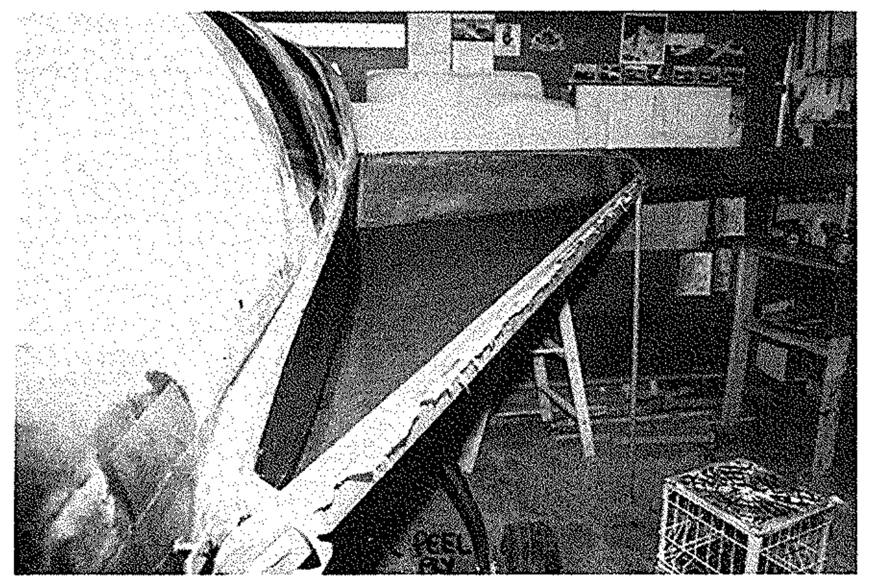
530. Right Tank. Fuel tank ribs. (SEE D-53 and D-54). Note 1,2, and 3 are temporarily in place (no skin) until after tank bottom is in place.



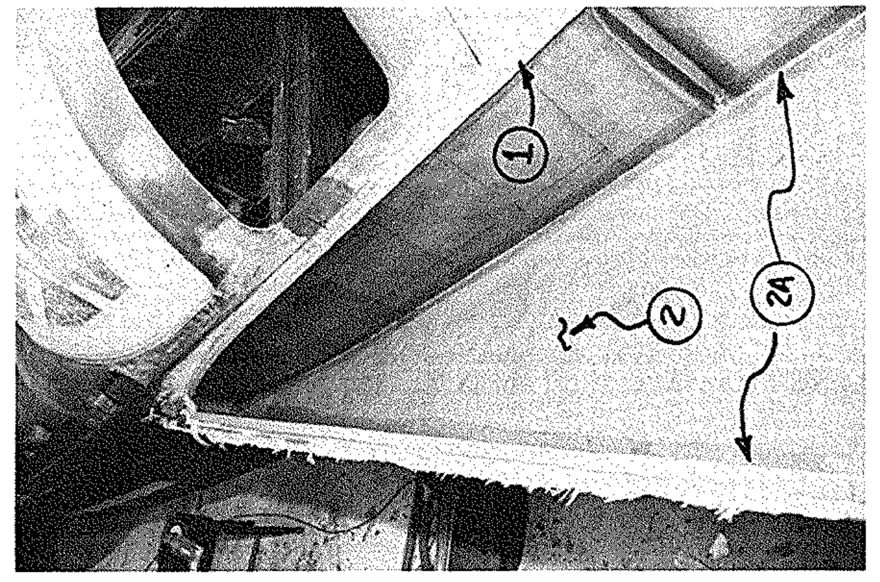
531. Right Tank. Showing layup #1 lips meets 3/8" foam held by wood support.



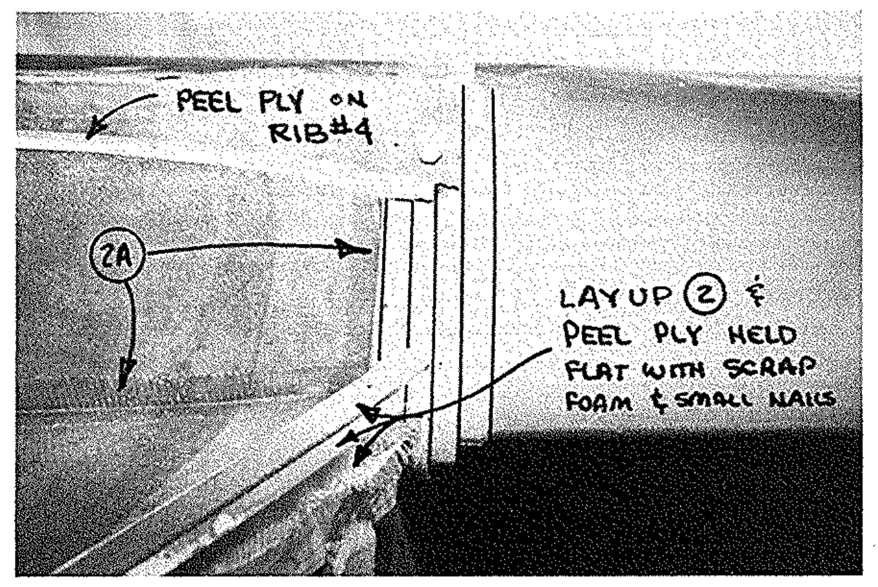
532. LEFT Tank. Slurry all bare foam on inside of tank and glass entire inside area with 1 ply BID (layup ②) plus run 2" wide BID tape along all joining surfaces of tank. (Layup (2A)). (SEE D-55).



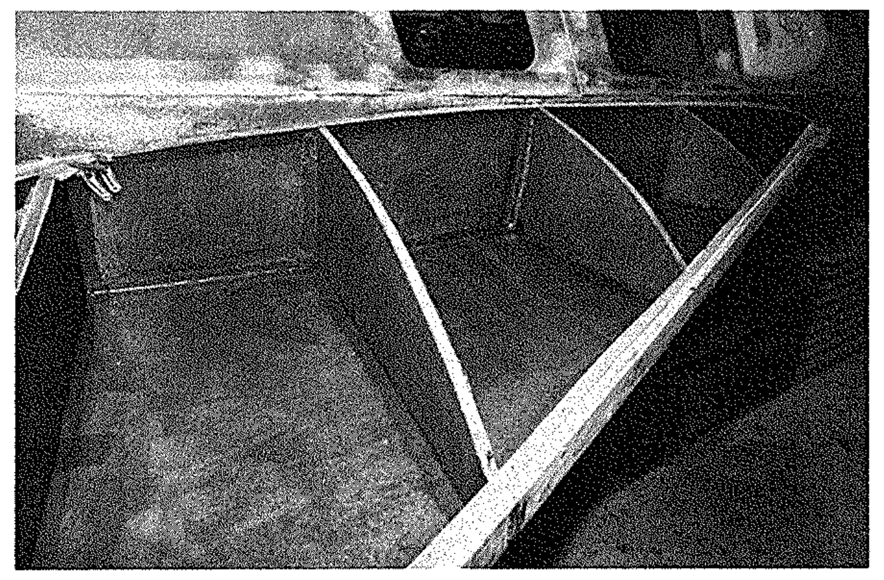
533. LEFT Tank. Note use of peel ply to prepare all edges and mating surfaces for lid.



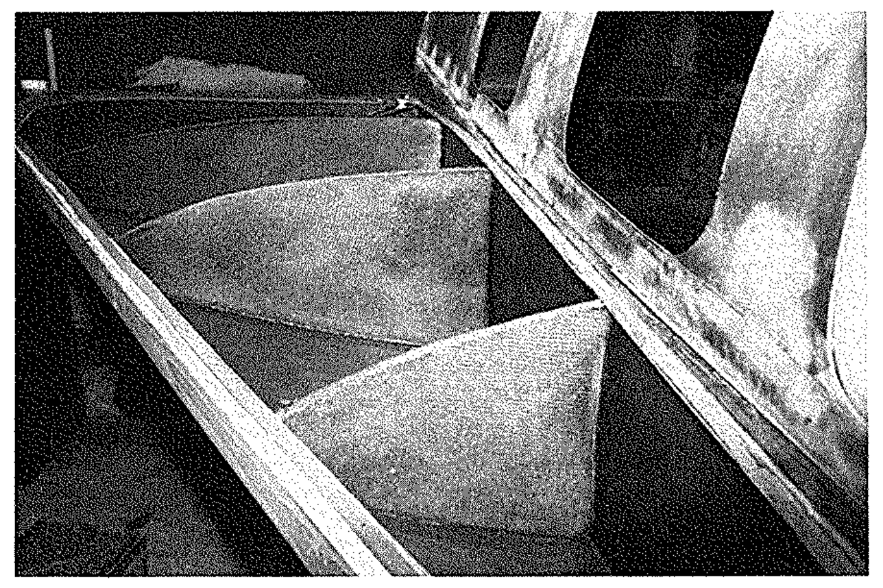
534. LEFT Tank. All fuel tank layups are done wet. Rich epoxy layups to prevent leaks.



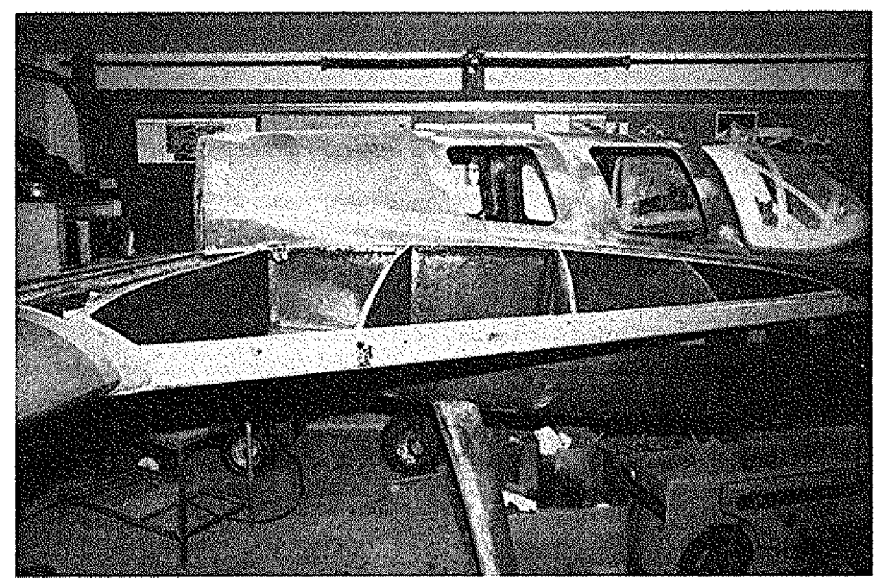
535. LEFT Tank. Shows 4 layers of 5/8" R45 plus layup ② and (2A).



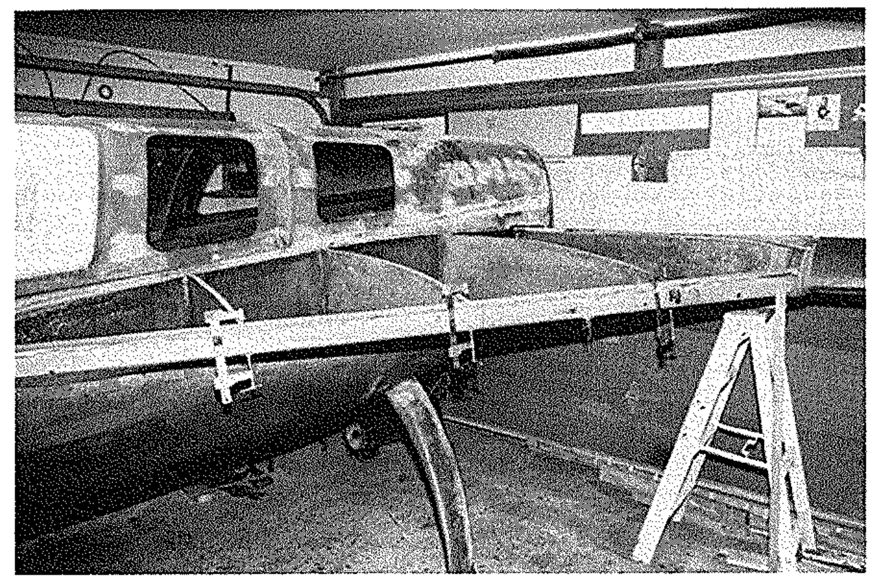
536. Right Tank. While layup ② (1 ply BID) is still wet. Slurry and glass ribs 1,2, and 3 (layup 2B) and install in tank.



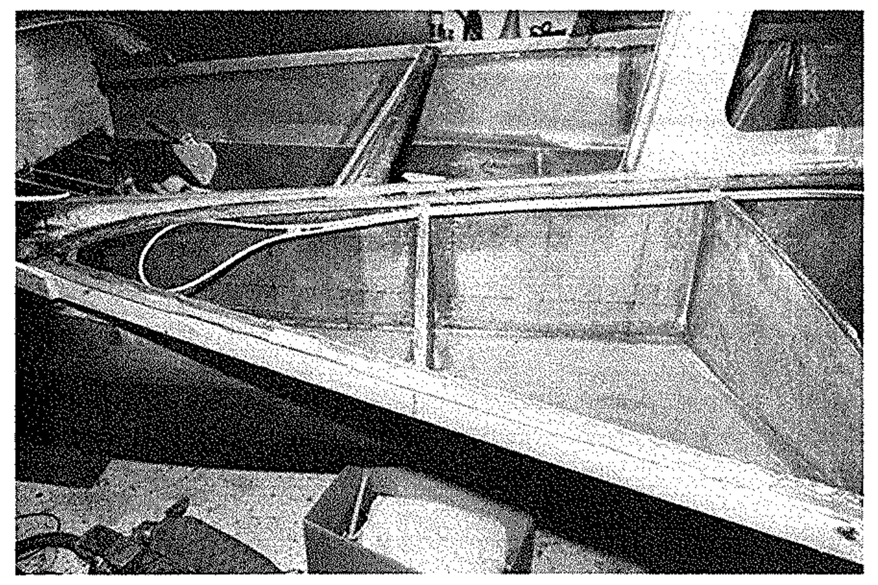
537. Right Tank. Make sure each rib has its "corners" clean to allow fuel transfer and venting.



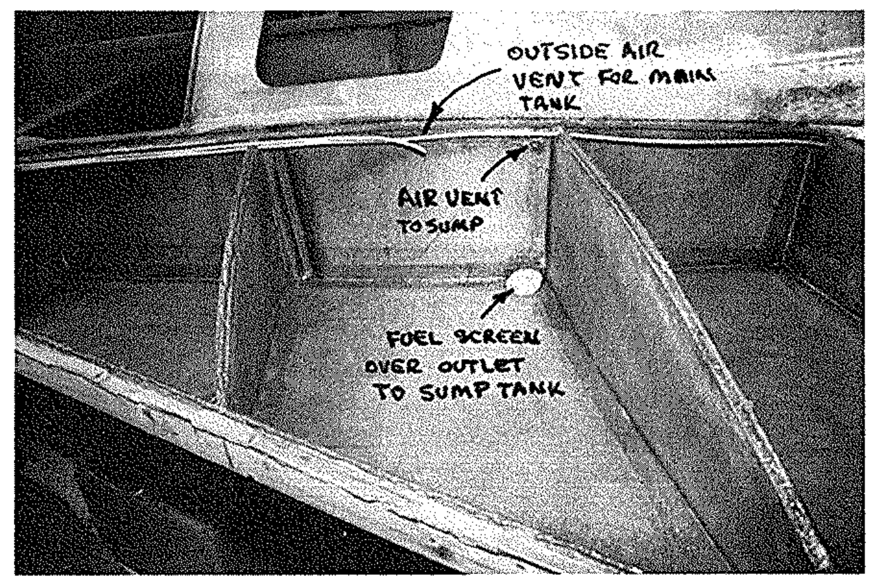
538. Right Tank. Layups ② and (2A) and with all ribs in tank. Peel ply required surfaces.



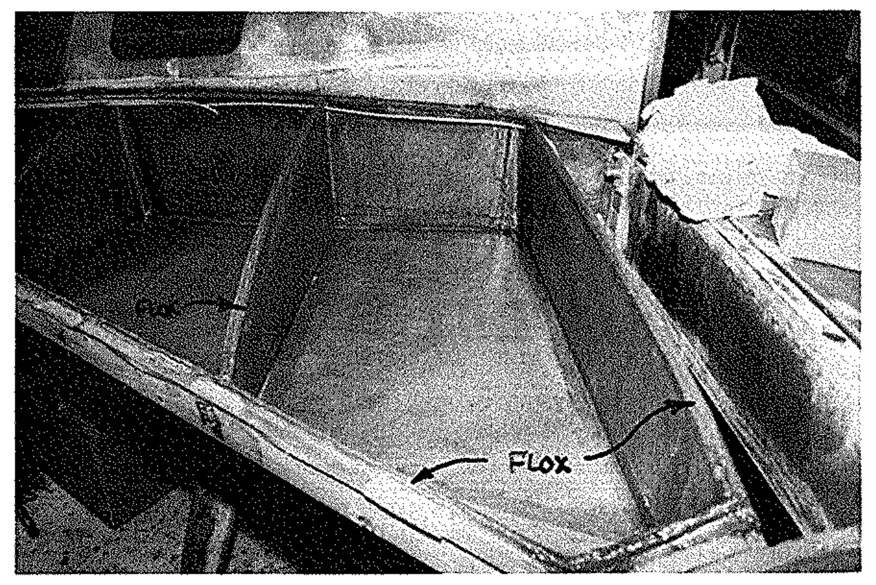
539. LEFT Tank. Completed bottom inside of tank. Clamps are holding end of ribs.



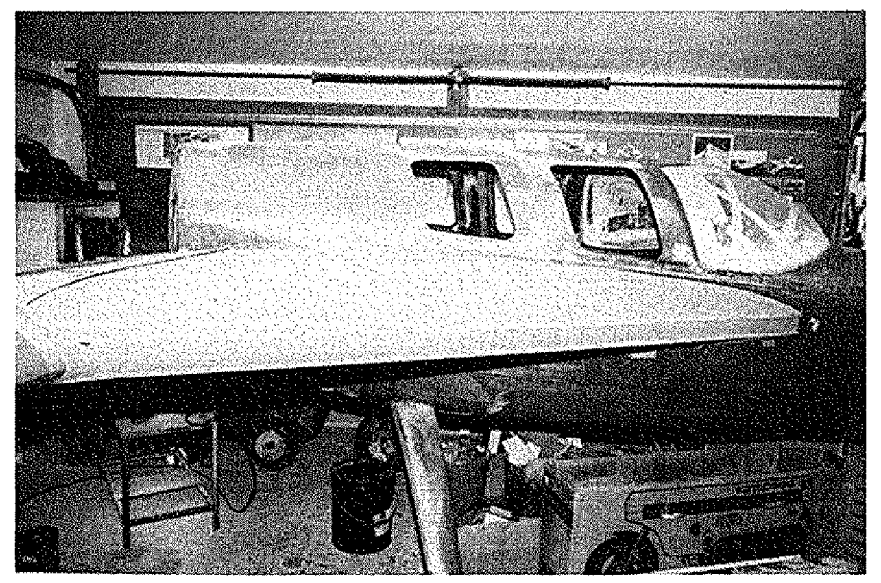
540. LEFT Tank. 1/4" x .032" 1200-0 ALUMINUM air vent tube. Flox in place.


OUTSIDE AIR VENT FOR MAIN TANK
AIR VENT TO SUMP
FUEL SCREEN OVER OUTLET TO SUMP TANK

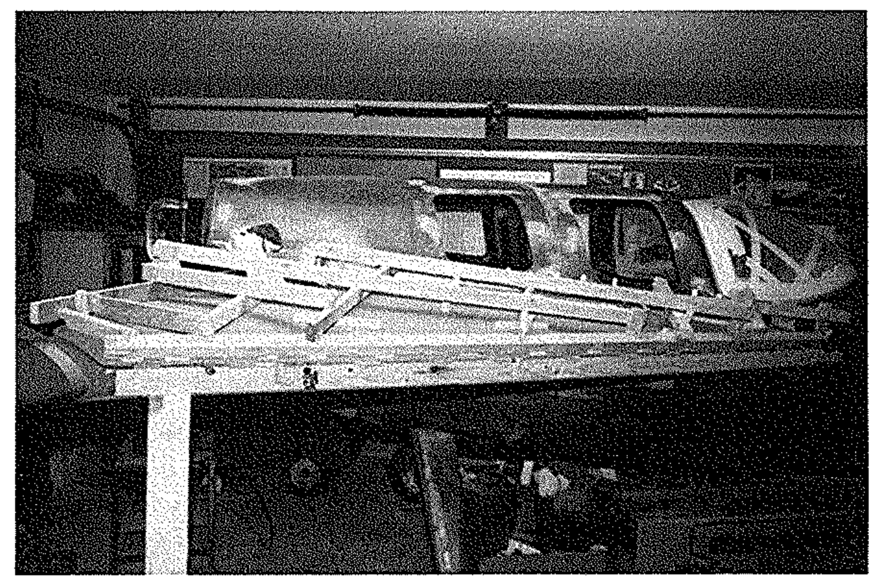
541. LEFT Tank. Air vent tube for main tank and air vent to sump plus fuel outlet to sump tank. (SEE D-55 and D-38).



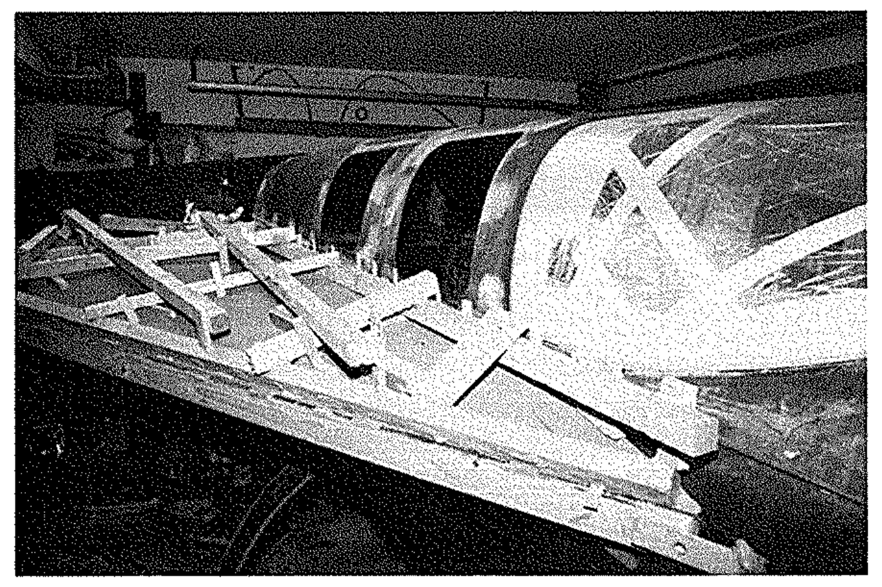
542. LEFT Tank. Note void area between aft end of tank and centersection spar. Flox is indicated for step done in Photo #548 and #549.



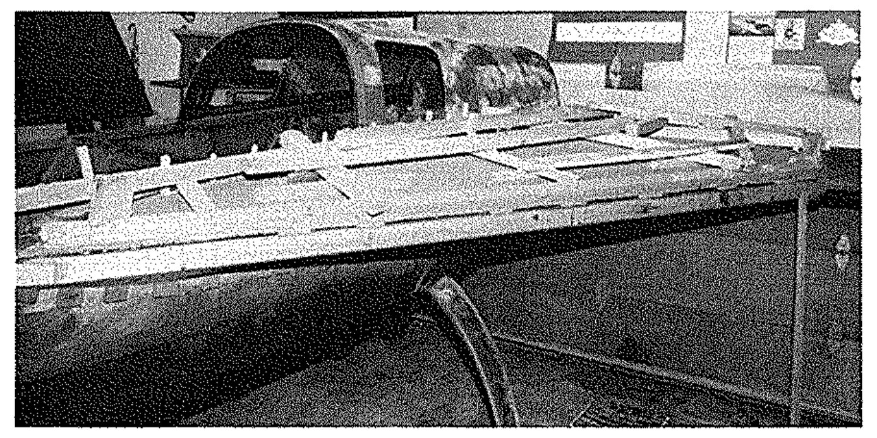
543. Right Tank. After inside bottom layup ② has cured, construct foam lid from 3/8" R45. Once lid is to required shape and curvature, build wood stiff back as shown in Photos #544, #545 and #546.



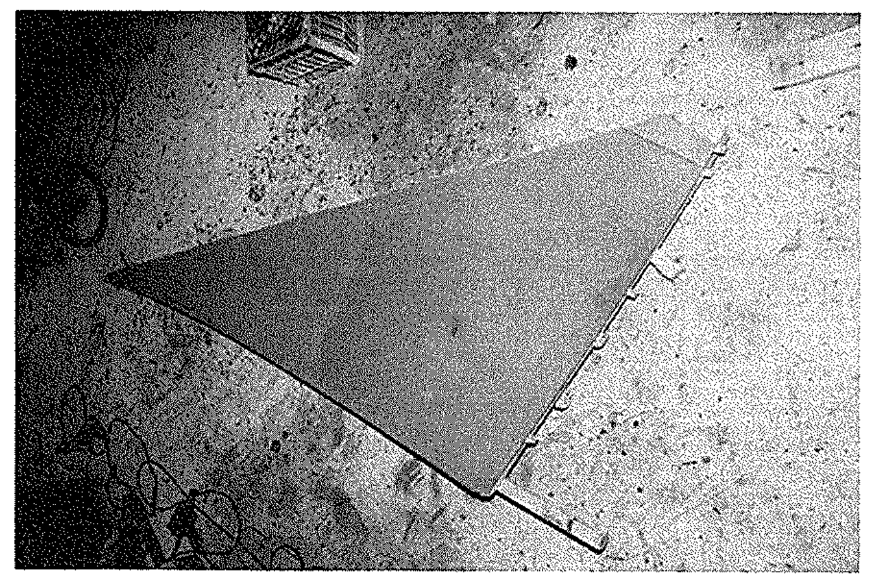
544. Right Tank. Use bondo to construct stiff back. (Make sure there is plenty of support).

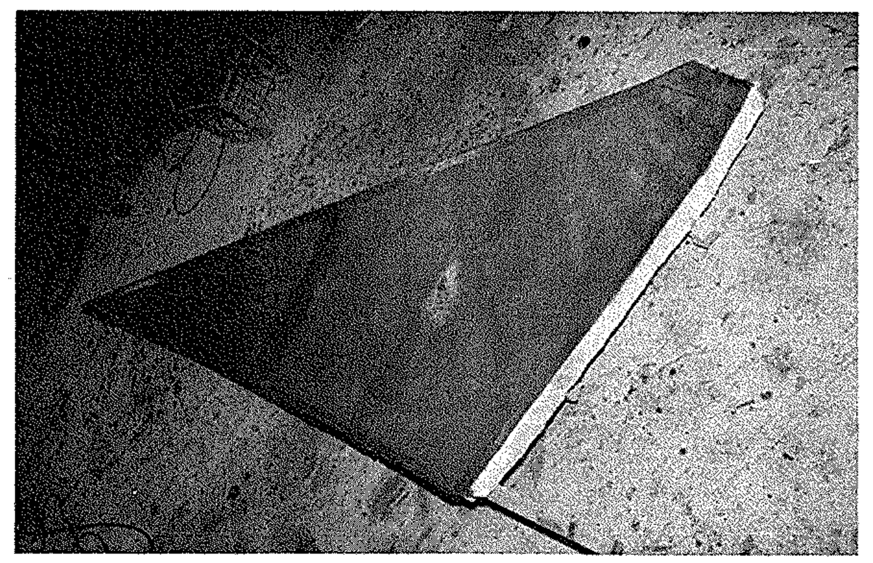


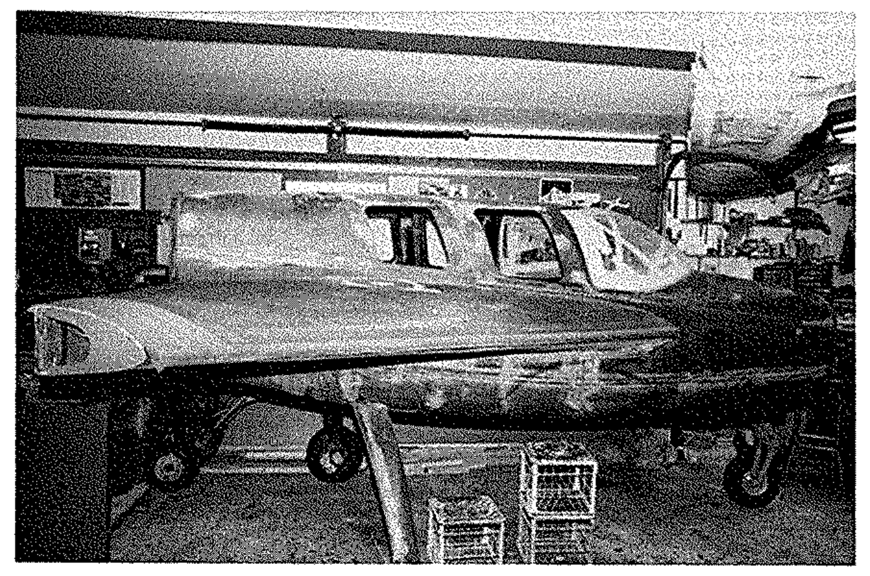
545. Right Tank. Stiff back continued.

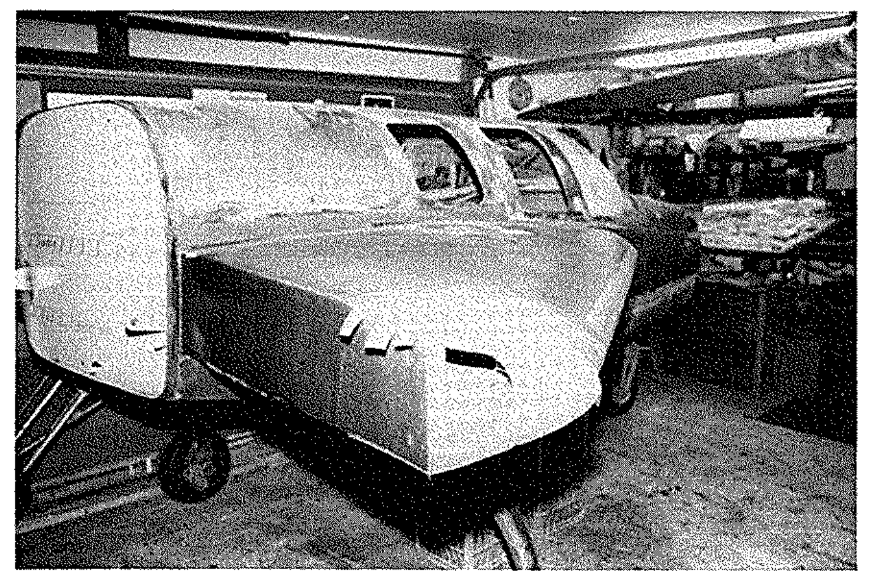


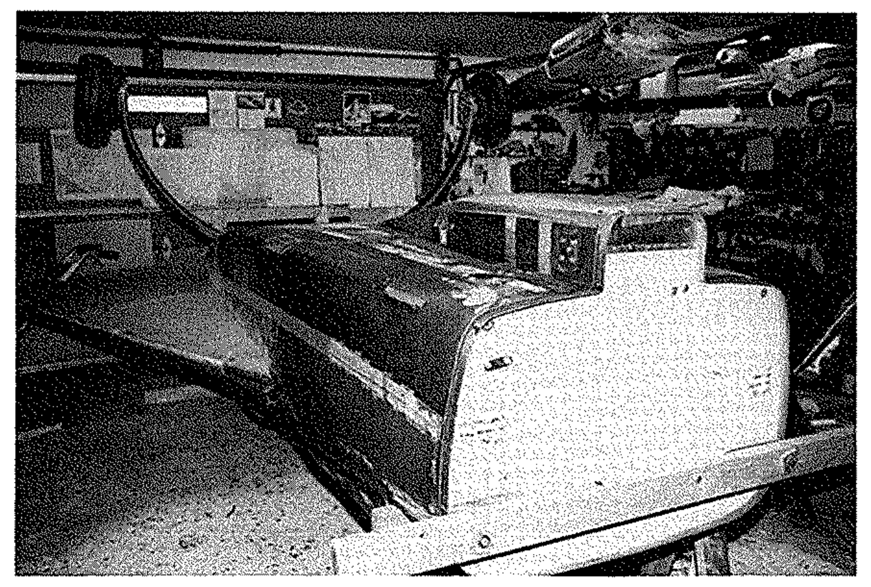
546. Right Tank. Stiff back holding left tank lid to proper shape.

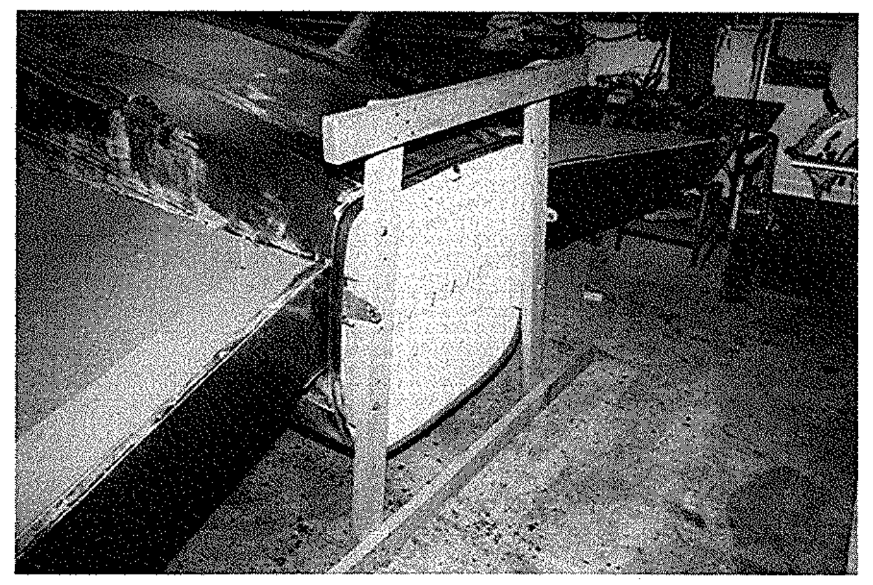

547. LEFT Tank Lid. (3/8" R45). Inverted on floor with stiff back holding shape. Slurry foam and do layup ④, 1 ply BID at 45°.

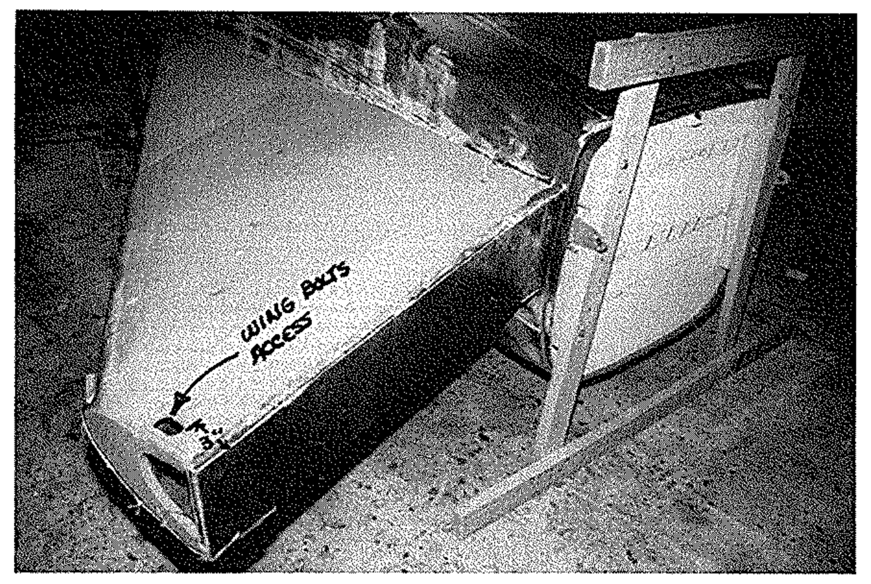

548. Allow layup ④ to become tacky (about 3 hours). Apply 3/8" to 1/2" high ridge of flox around entire opening of tank and across ribs. (SEE photos #540, #541 and #542). Check inside tank for everything being done. Continue #549.


549. Reinstall lid. Weight and clamp in place and allow 24 hour cure. Remove stiff back and temporary wood leading edge support. Install foam leading edge, fuel cap flange and bottom cover between tank and centersection spar.

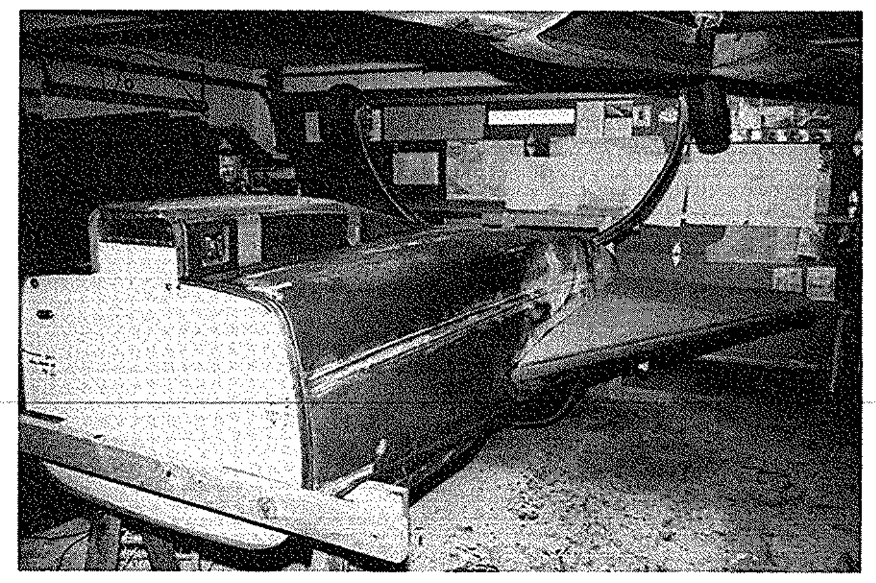

550. Do layups ⑤ and ⑥. Install #5 and #6 ribs (with 1 ply BID EACH SIDE). Place top lid between tank and spar with layup (6B). Shape all of foam tanks, slurry and do layup ⑦.

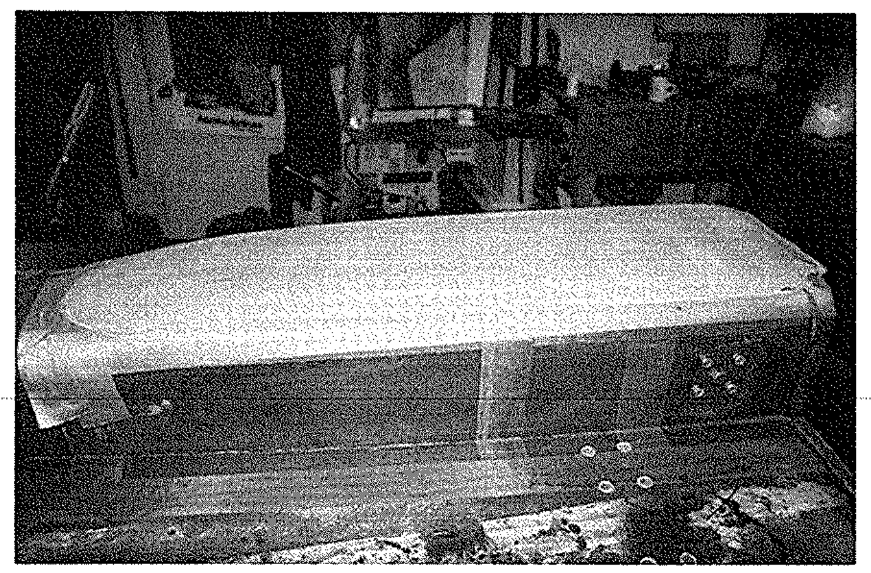

551. After tops of both tanks are done turn fuselage upside down to do layup ⑧. 2 PLIES UND AT ORIENTATION SHOWN ON D-56.

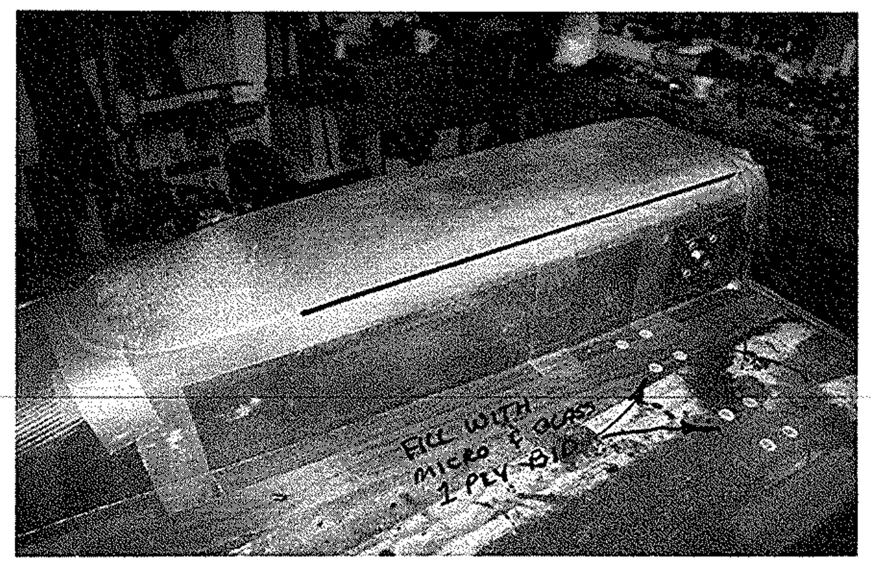

552. Wood 2 x 4 fixture attached to motor mount holes to support AFT end and aid in turning fuselage over. It takes 6 people to safely flip it over.



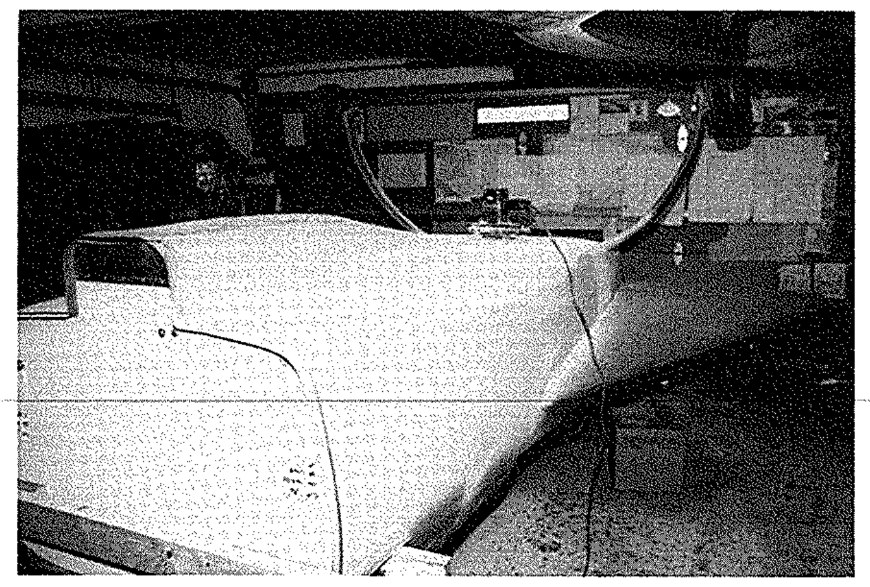
553. Wing bolts access hole cut in bottom side only. Hole is covered with .016" aluminum plate held in place with RTV (silicone). Hole at end of spar is temporary to install WA-4A etc. (SEE D-56).

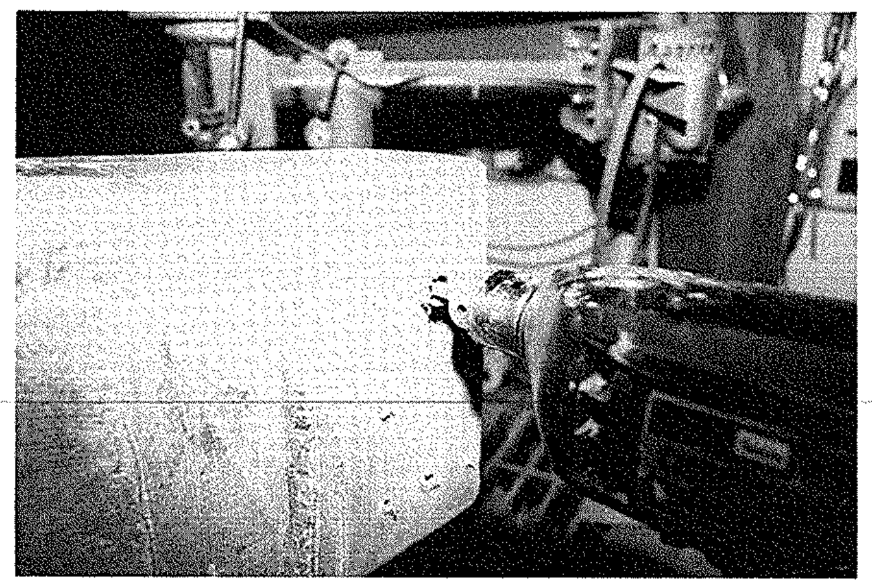

554. To aid in handling attach 2 x 4 to forward motor mount holes. Do layup 8 tank bottom skins. Elevate aft end of fuselage, sand areas required and do layups ⑨ and ⑩ as described on D-56.

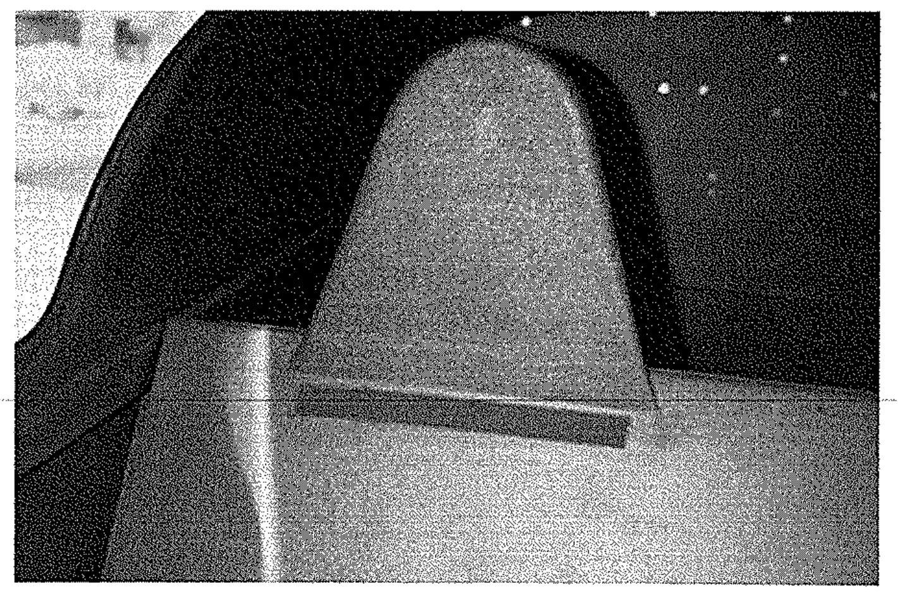

555. Using heat gun, form 1/4" foam nose gear doors. Glass both in and outsides of each door with 2 PLIES BID AT 45°. Plus add 2 PLIES BID 1" wide tape to inside area of each door at hinge location. (SEE D-36).

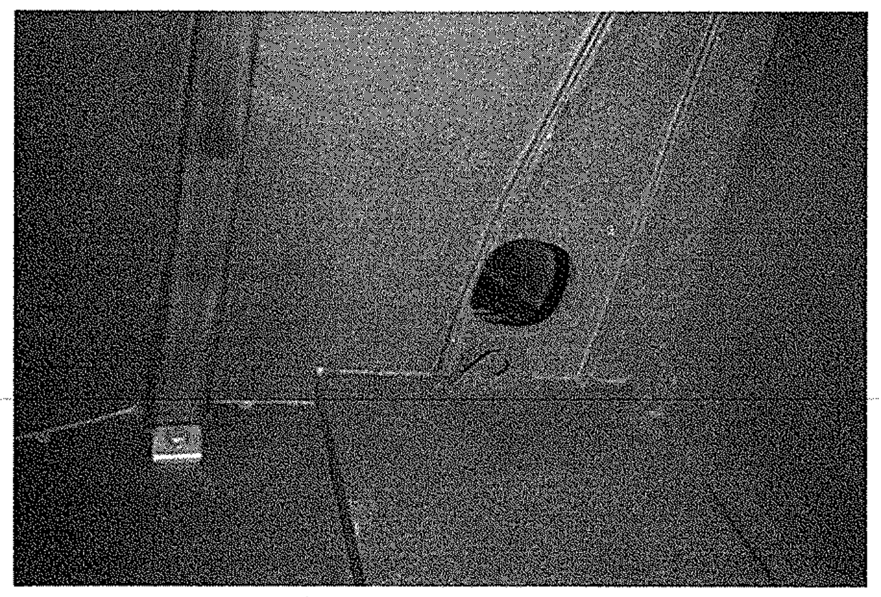


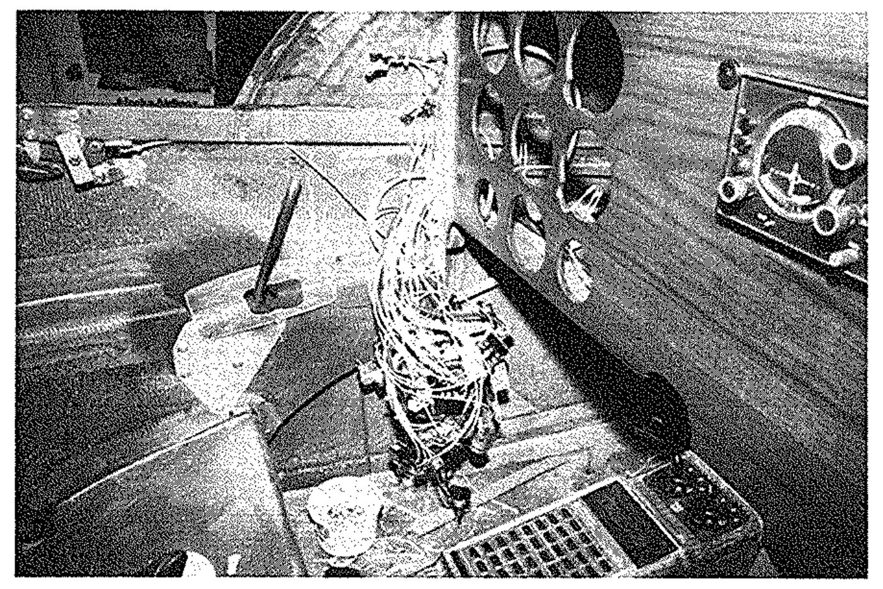
556. Cut slot in doors for hinge. Further information will be shown in newsletters as to the door retract mechanism not fully tested at this time. Fill holes for master cylinder bracket bolts with dry micro and cover with 1 ply BID.

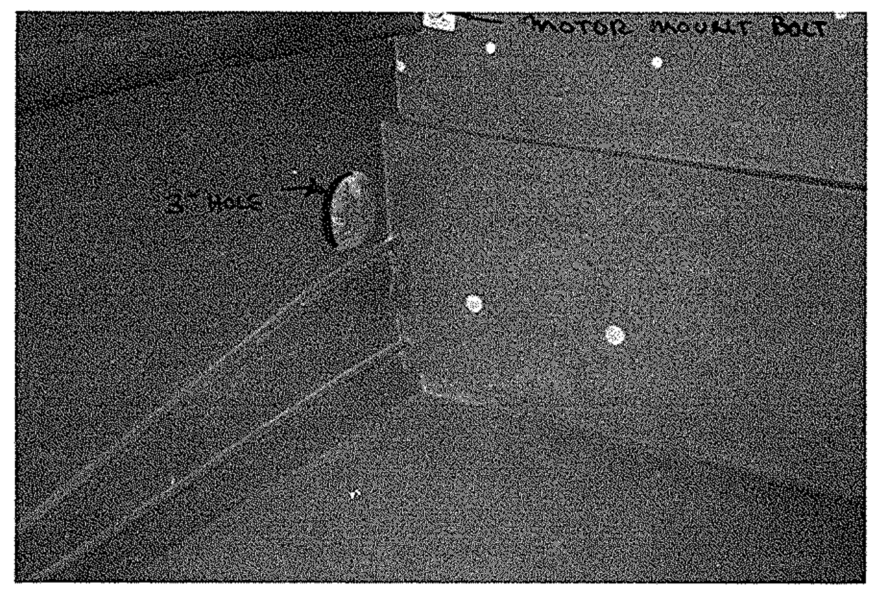

557. After all glassing is complete and fuselage is still upside down, complete all filling and feather fill processes including primer on entire bottom of fuselage and tanks.


558. Drill out layups ⑨ and ⑩ using previously drilled holes as guides for each wing attach location. Install all wing hardware WA-3, WA-4 etc.

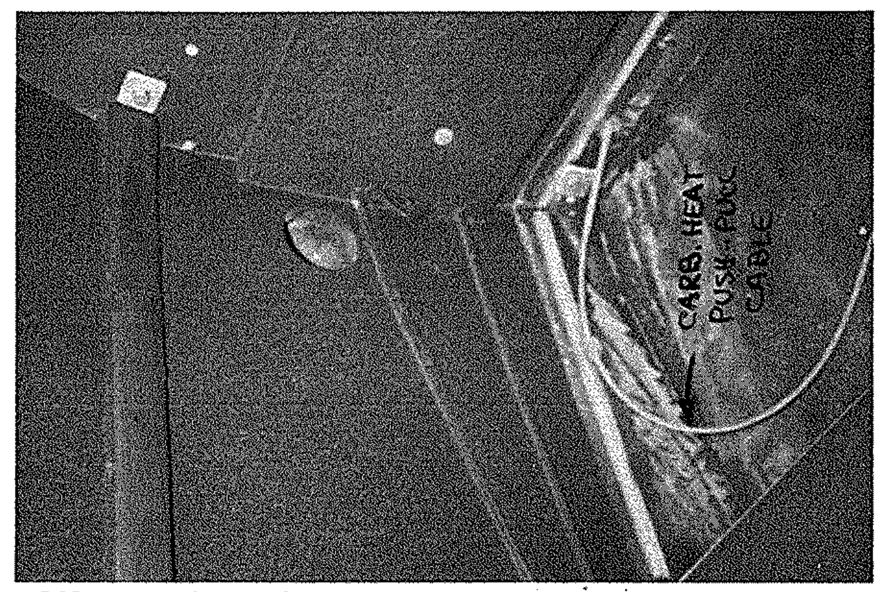

559. Head rest on folding seat back.


560. Left rear corner of fuselage. Note 3" hole between aileron cable conduits is for access to inboard wing attach bolt. (SEE Photo #524).

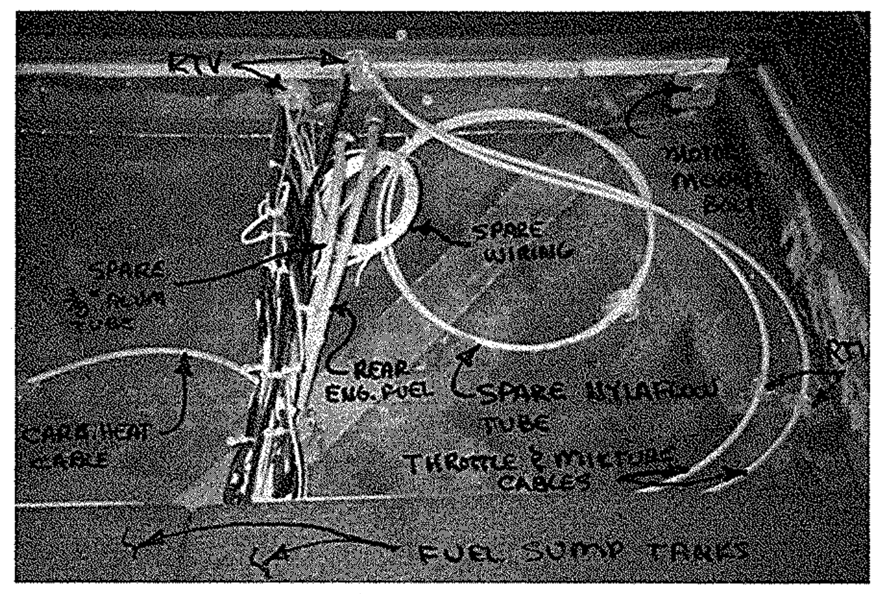

561. Wiring to fuses and switch in main control panel.



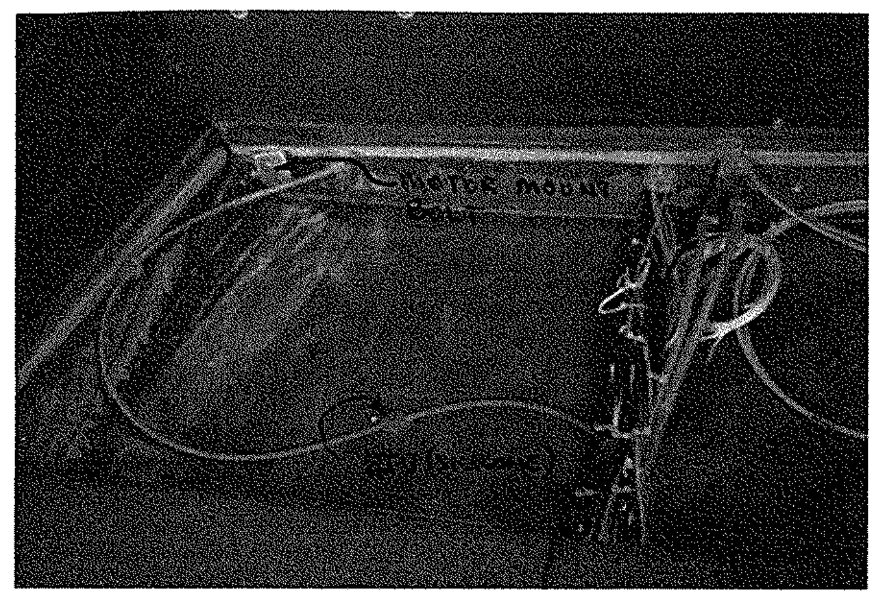
562. Right rear corner of fuselage. Note 3" hole above aileron cable conduits for access to inboard wing attach bolts. (SEE Photo #523).



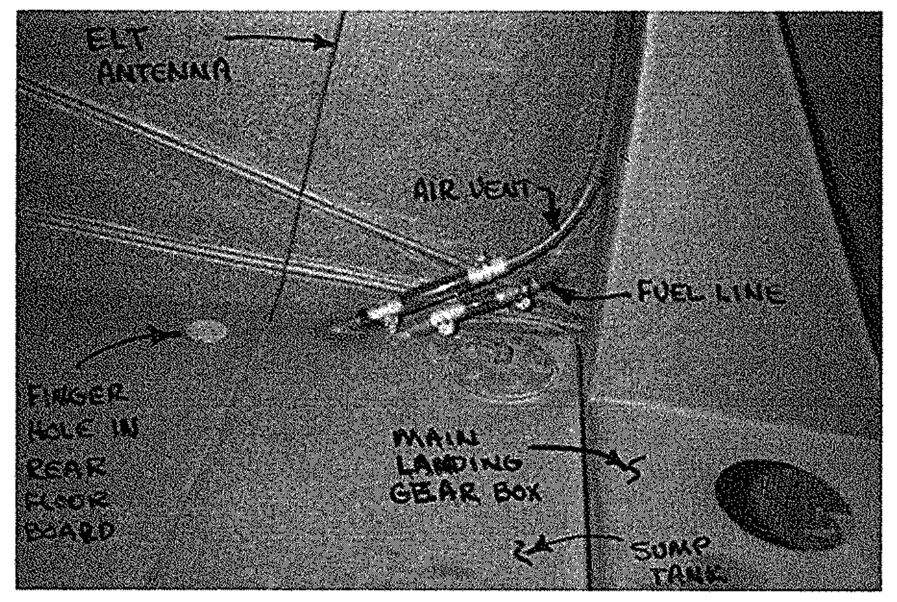
563. Routing of carb heat push-pull cable. Note aileron cable conduits, positioned and covered with 1.5" wide BID tape.



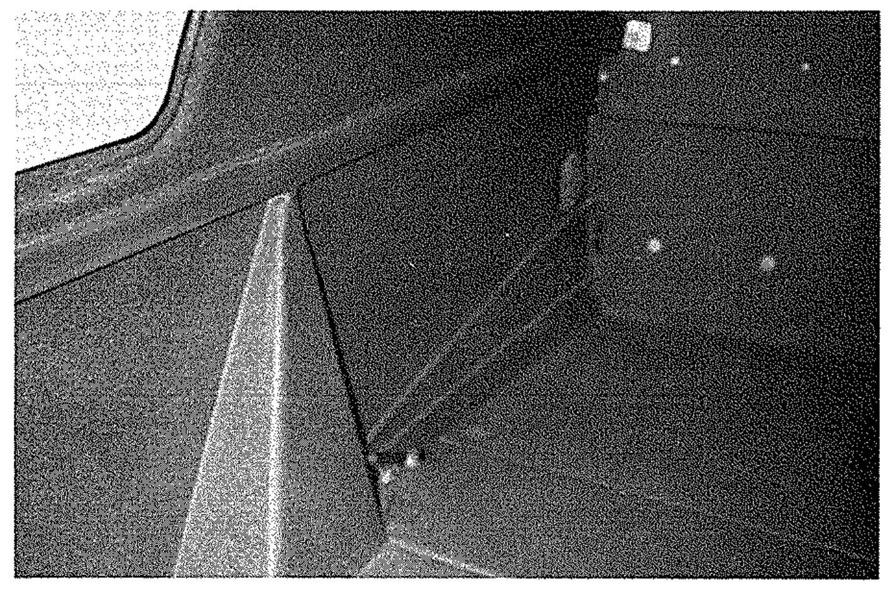
564. Rear compartment with floor board removed. Good area for storing spar wiring, tubes, etc. and to slack in push-pull cables.

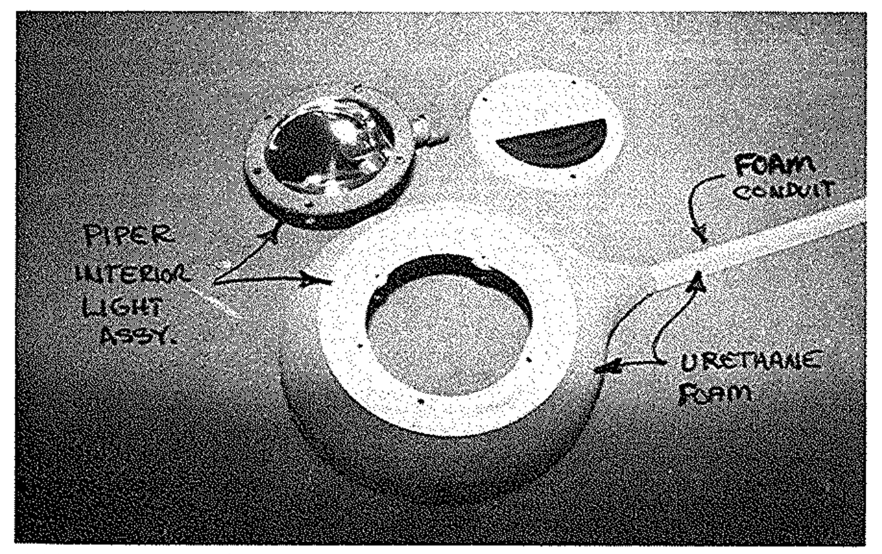


565. Rear Compartment.

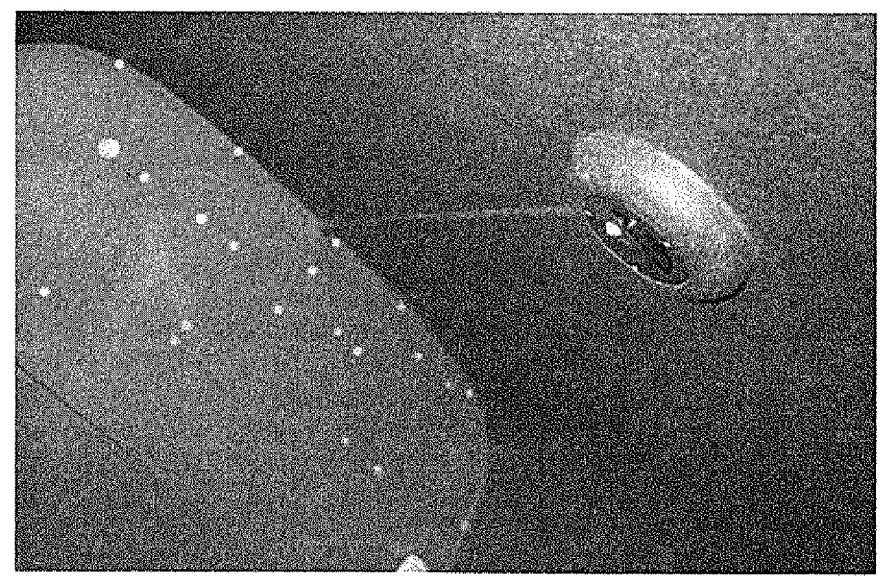


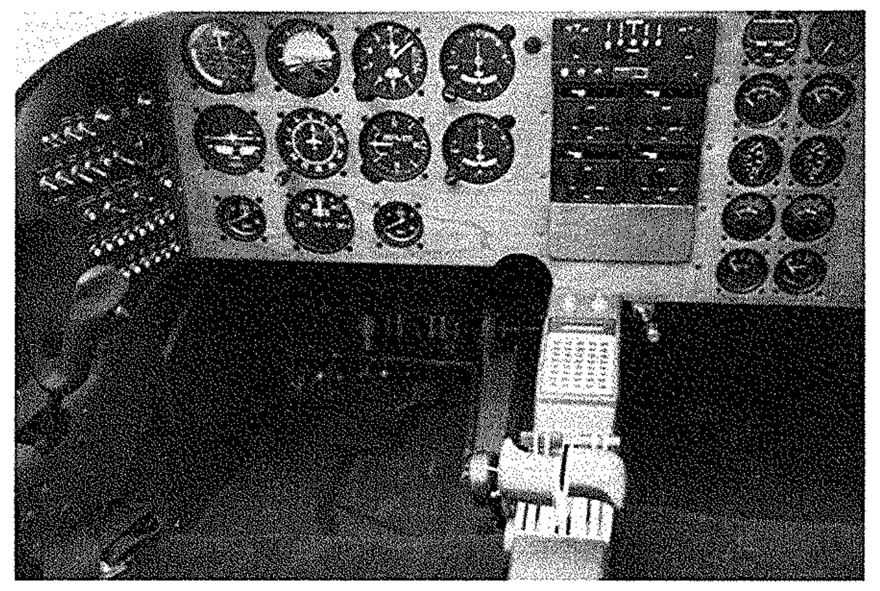
566. Completed installation of sump tanks, fuel lines, floor board, etc.

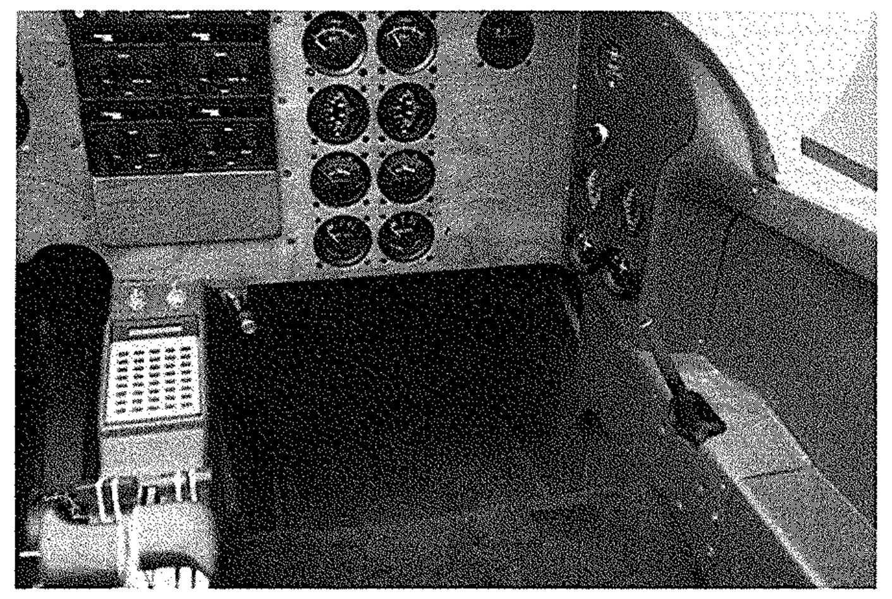

567. Defiant #002 used Zolotone paint throughout inside surfaces. Has excellent hiding characteristics.

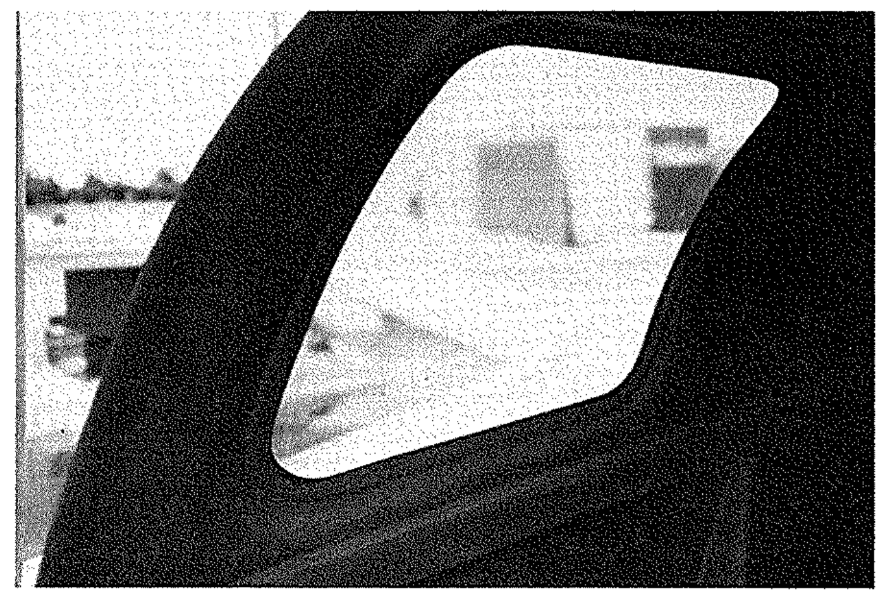


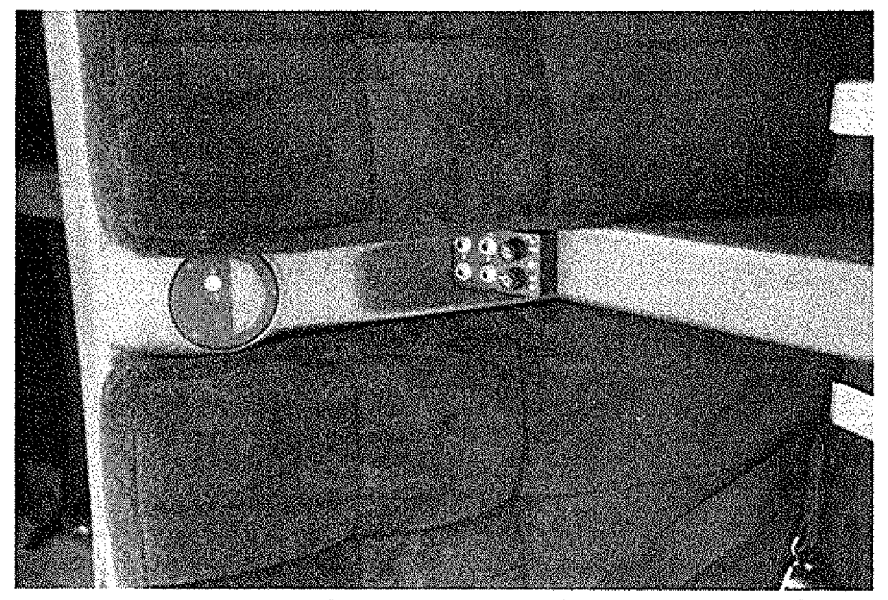
568. Use urethane foam shaped to desired requirement and covered with 1 to 2 plies BID depending on location. Foam conduit is covered with 1 ply BID and after cure a wire is used to rout out foam and pull in wiring.

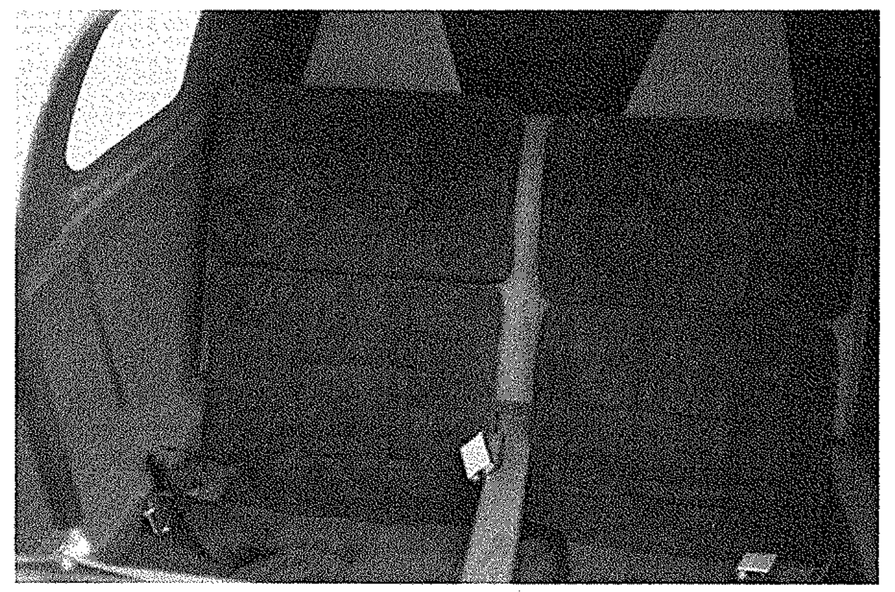

569. Finish product of Photo #568.

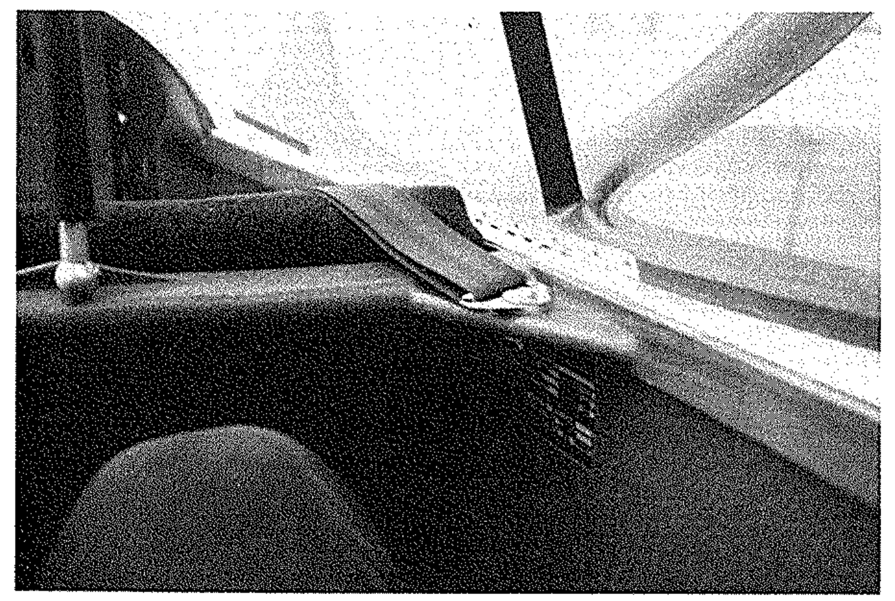

570. Instrument Panel. (Left)

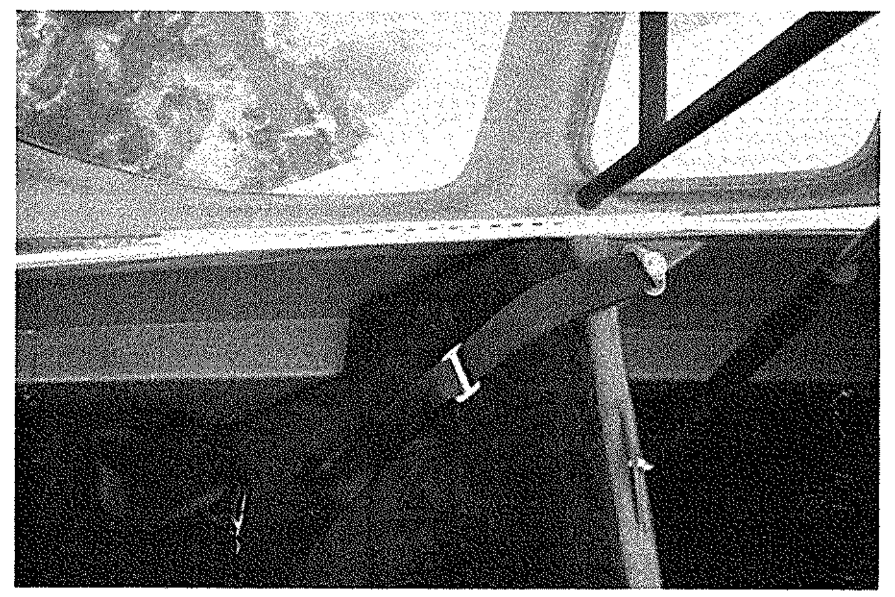

571. Instrument Panel. (Right)

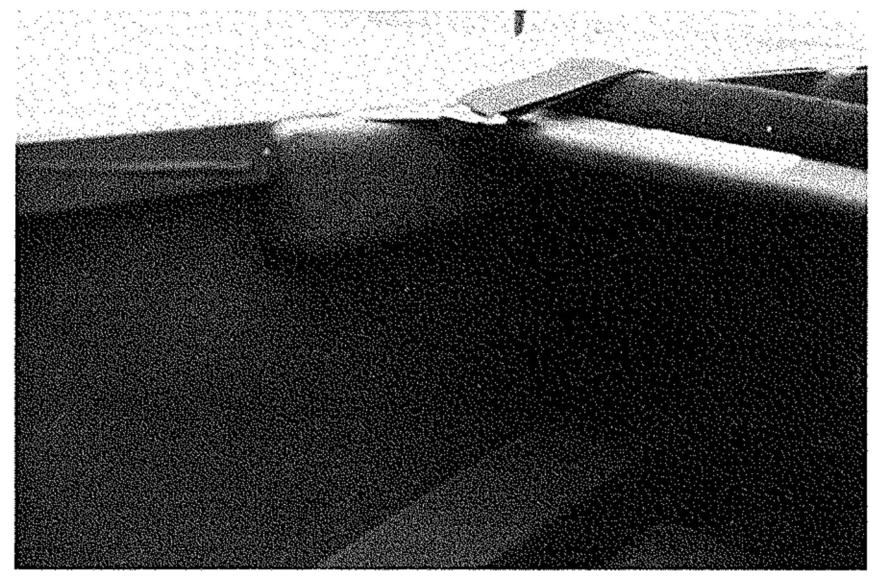

572. Side Window (RIGHT REAR).

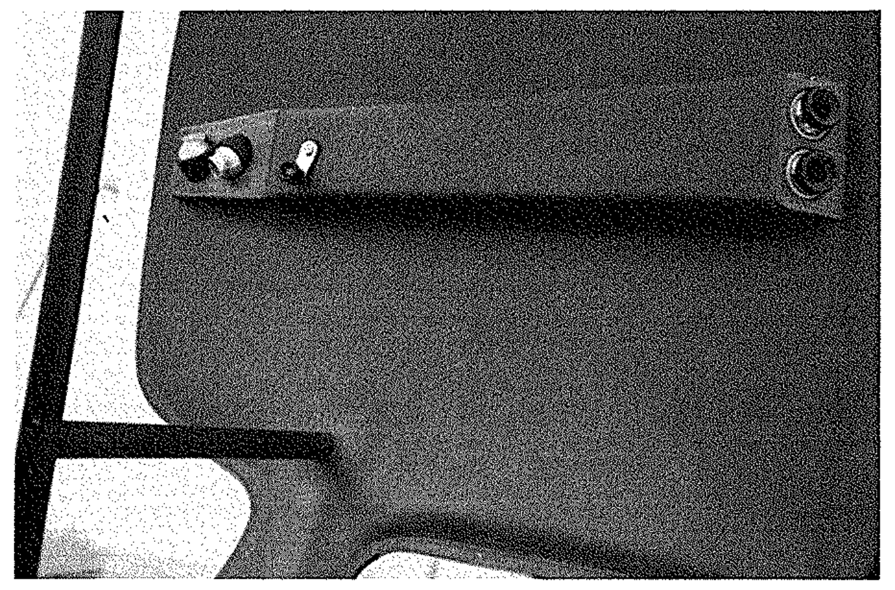

573. Center console between pilot and co-pilot. Used another Piper interior light for instrument panel lighting. Also note RST intercom (442B).

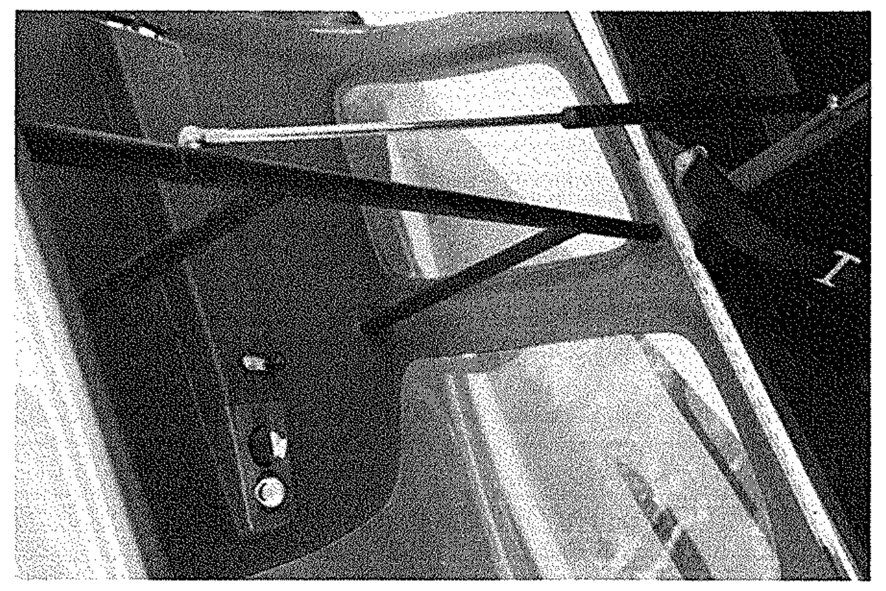

574. Rear seat area. Seat and back cushions are divided into 3 sections for better storage during times when area is used for bed or cargo.

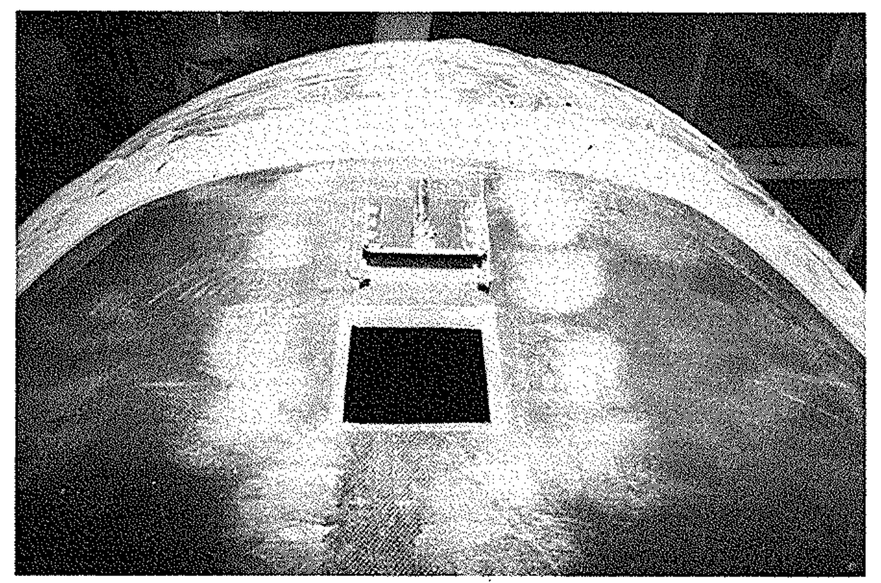

575. Hinge (canopy) and right seat shoulder harness attachment. Note plans show a different and better system. (SEE sketch on D-51)

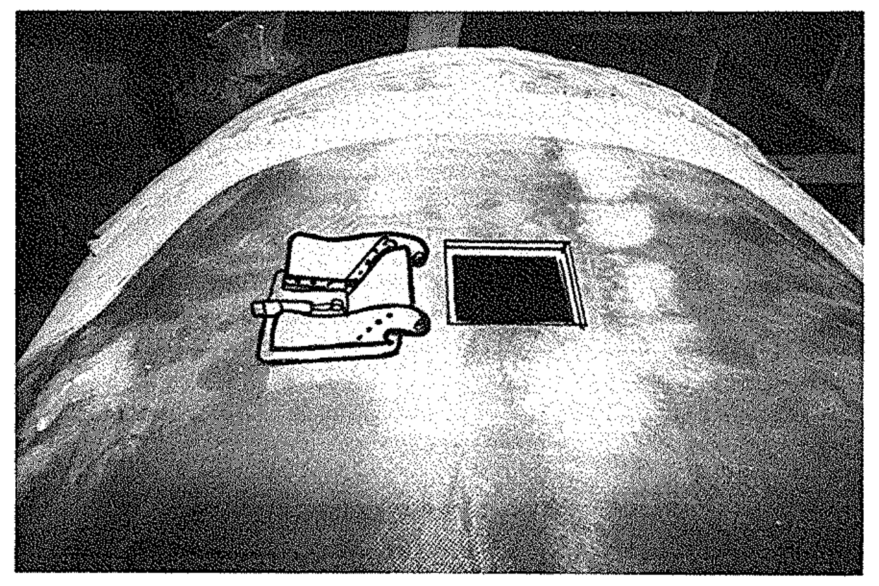

576. Right side co-pilots seat. See gas cylinder attachment on D-51.

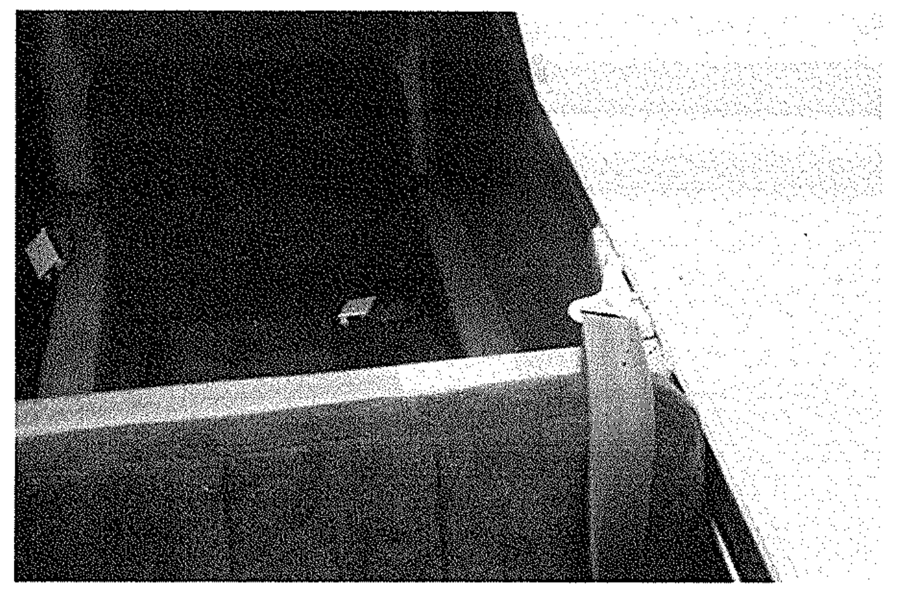

577. Left Side pilots shoulder harness attach. (SEE D-51). Note cover over rear canopy latch.

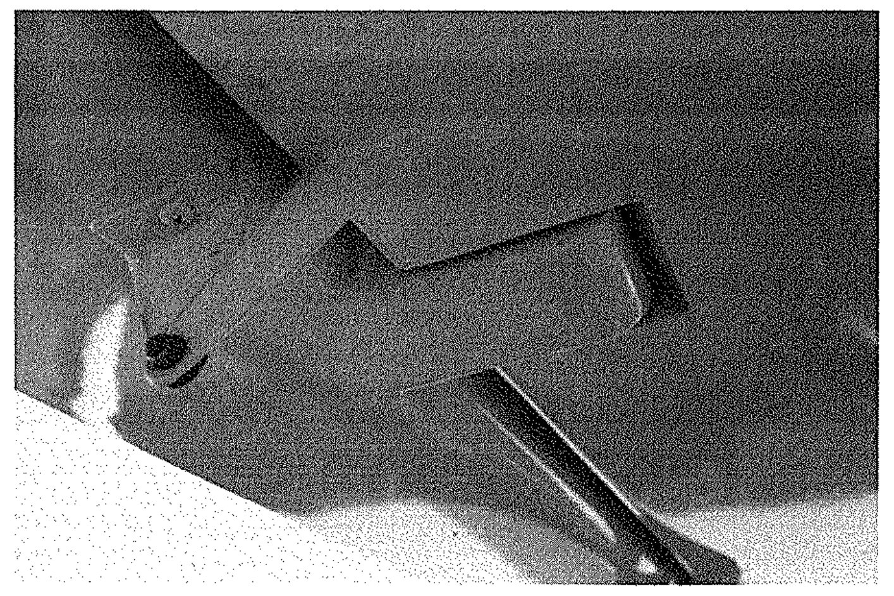

578. Over head air vent console. USE 1/4" R45 foam. Cover with 1 ply BID on inside and outside. Build to your preference.

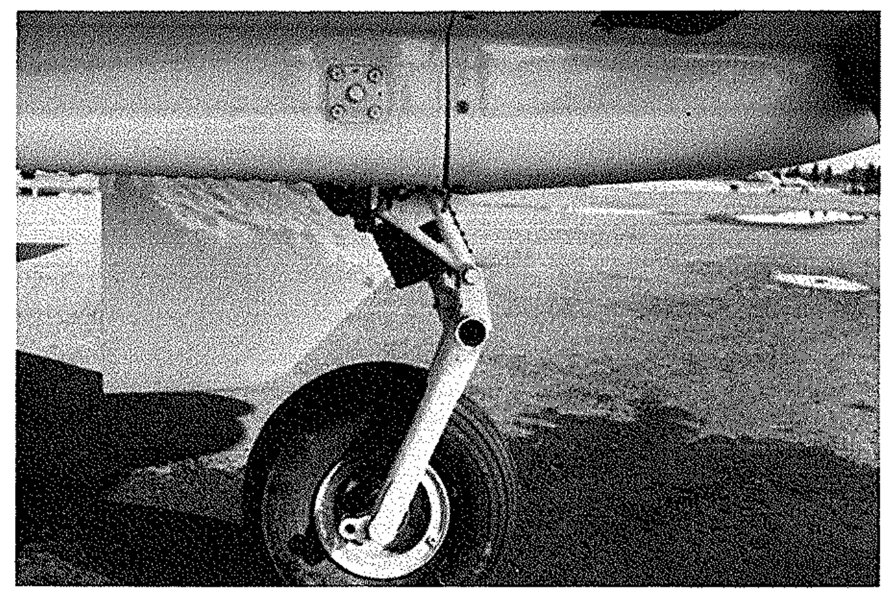

579. Cross tube and gas cylinder.

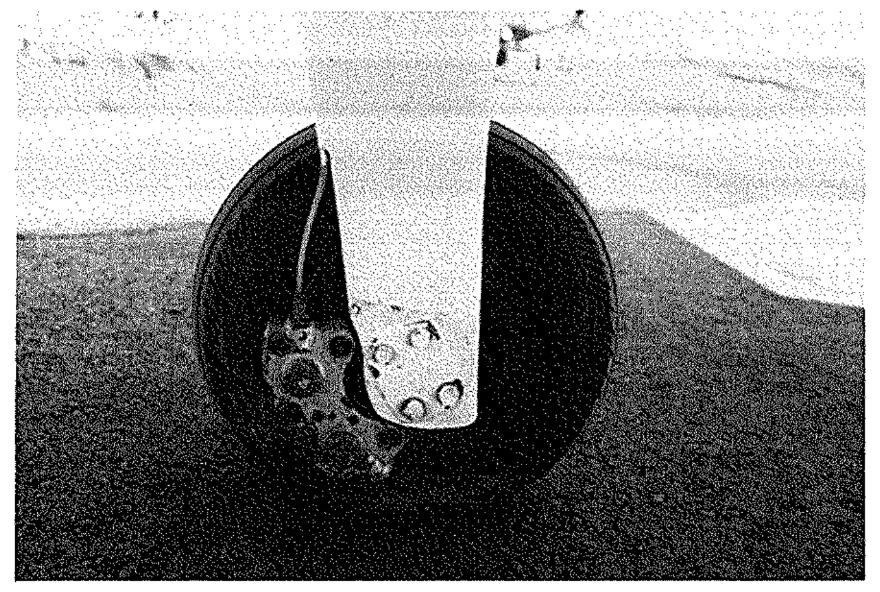

580. Air vent in top of canopy. Good for air to face and head area but can be a problem in rainy conditions unless covered at all times with canopy cover.

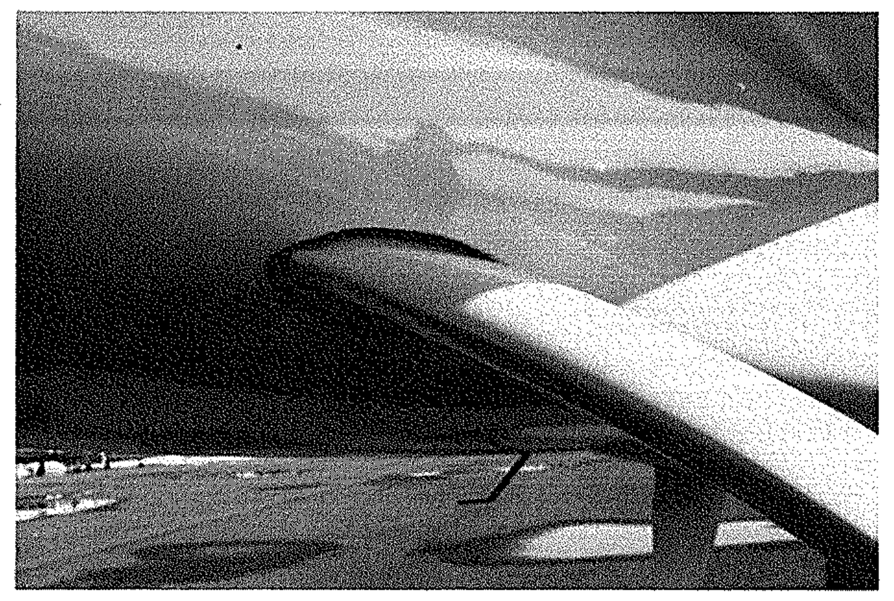

581. Air vent continued.

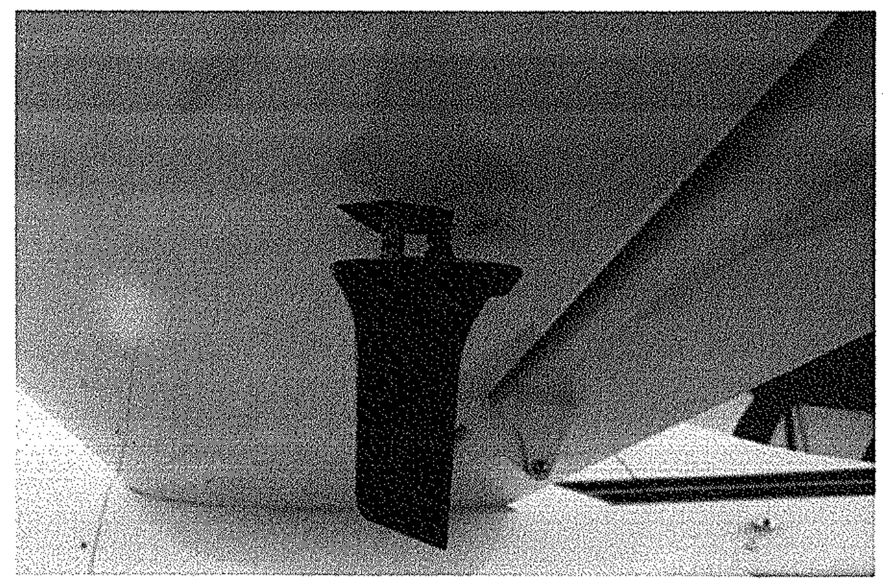

582. Pilot's shoulder harness attachment.

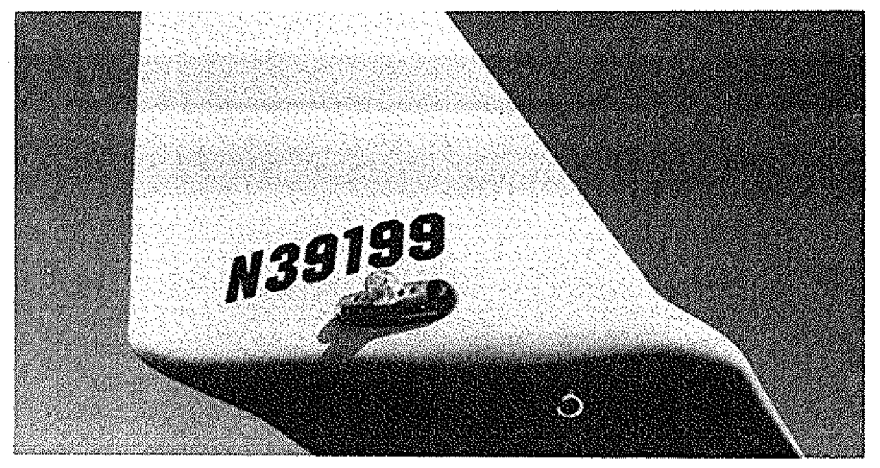

583. Elevator mass balance weight and hinge.


584. 3-Donut Mooney nose gear - gear doors not installed.


585. Main gear strut. Note position of brake caliper.


586. Main gear strut/fuselage juncture. Fill this groove with RTV silicone.


587. Pitot static shown loose from canard for clarity.



588. Wingtip detail showing nav/strobe light and tie down ring.

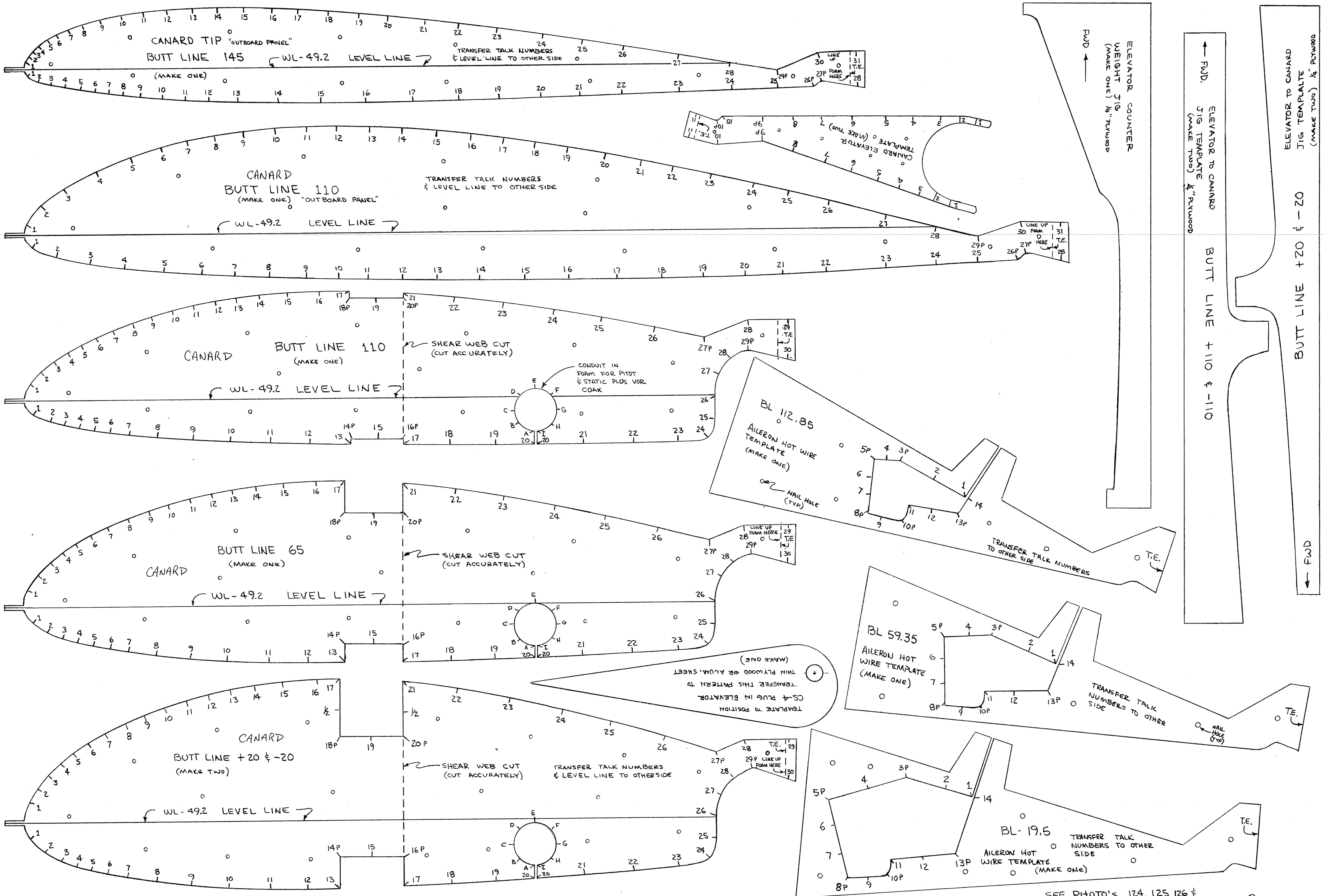
SHEAR WEB CUT (CUT ACCURATELY)
INBD.
WINGLET ROOT @ WL 55.4
(MAKE ONE)
TRANSFER TALK NUMBERS & BUTT LINE TO OTHER SIDE
USE AS LEVEL LINE WHEN HOT WIRING
BUTT LINE 183
NAIL HOLE (TYP)
LINE UP FOAM HERE
T.E.
FS 249
A
B
C(P)
D(P)
E
F
B(P)
C(P)
D
WINGLET ROOT WL 55.4 SPAR CAP BRIDGE TEMPLATE
SPAR CAP OUTLINE
TOP
UP
FWD
USE AIRFOIL TEMPLATE TO PATTERN EACH NAIL HOLE
WINGLET MID SPAN WL 83.7 SPAR CAP BRIDGE TEMPLATE
3 SHEETS 1/2" PLYWOOD 4'X8'
CUT
96"
48"
24"
12"
SHEAR WEB CUT (CUT ACCURATELY)
WINGLET MID-SPAN @ WL 83.7
(MAKE ONE)
USE AS LEVEL LINE WHEN HOT WIRING
BUTT LINE 179
TRANSFER TALK NUMBERS & BUTT LINE TO OTHER SIDE
LINE UP FOAM HERE
T.E.
FS 257
WINGLET TIP @ WL 112
(MAKE ONE)
TRANSFER TALK NUMBERS & BUTT LINE TO OTHER SIDE
USE AS LEVEL LINE WHEN HOT WIRING
BUTT LINE 175
NAIL HOLE
LINE UP FOAM HERE
T.E.
FS 265
WOOD WORK TABLES
96"
48"
1.7
1.9
9"
45°
RUDDER TIP
(MAKE ONE)
LEVEL LINE
DO NOT TRANSFER #s
T.E.
RUDDER ROOT TEMPLATE
(MAKE ONE)
USE AS LEVEL LINE WHEN HOT WIRING
DO NOT TRANSFER TALK NUMBERS TO OTHER SIDE.
NAIL HOLE (TYP)
T.E.
WL 50.212
SEE PHOTO'S 124, 125, & 126
1/4" PLYWOOD (MAKE ONE)
USE ONLY AT BL 112.85
MAIN WING LEVELING TEMPLATE
THIS LINE IS LEVEL WITH WATER LINE ON TEMPLATE BL 112.85

ALL DIMENSION OF LUMBER ARE ACTUAL OF 2X4'S

REQ. MATERIAL TO BUILD
2 EACH 96" TABLES &
2 EACH 48" TABLES
(CAPABLE OF 4' TO 24')

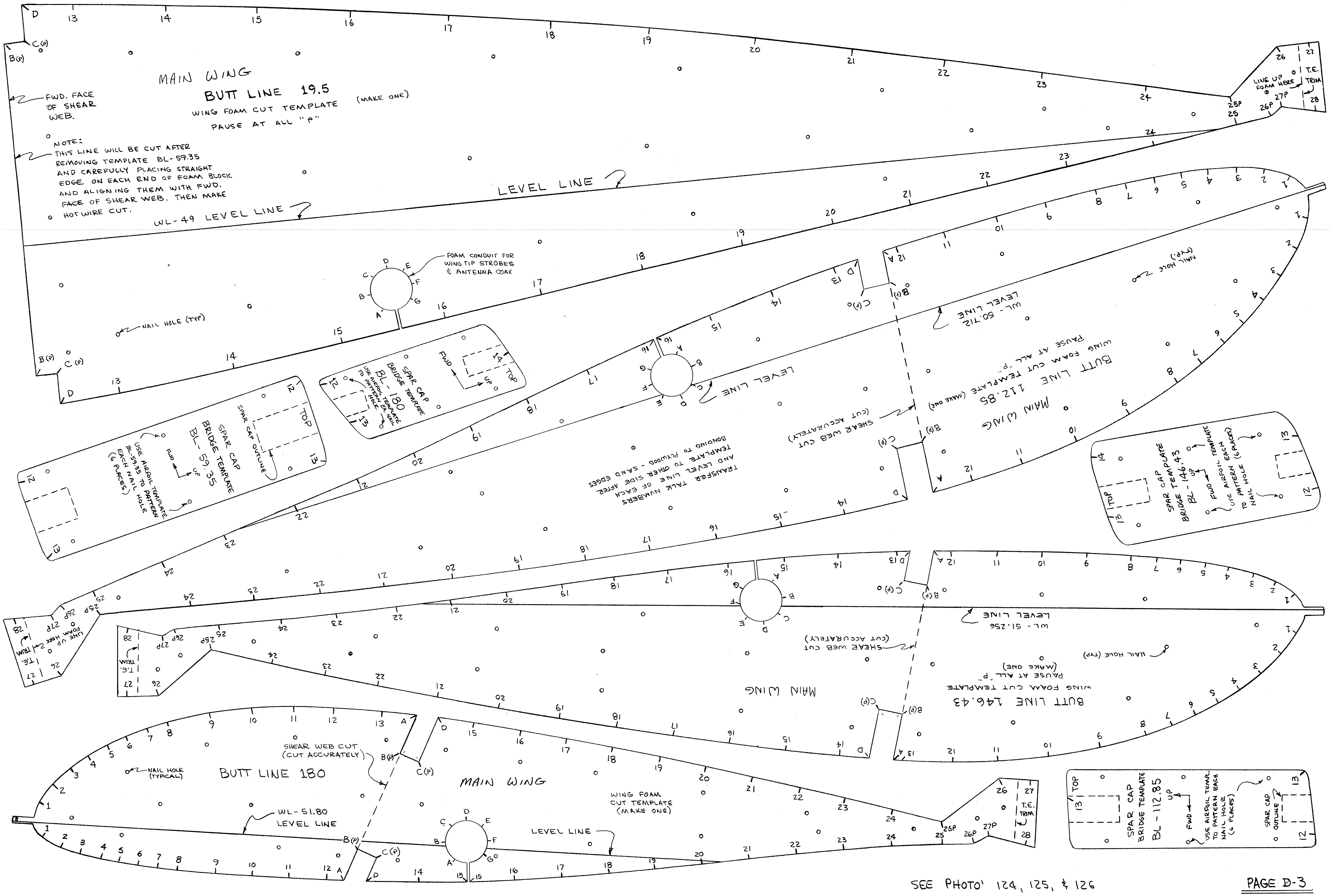
3 EA. 1/2"X48"X96" PLYWOOD

Ⓐ 22 EA. 1.5"X3.5"X22.9"
Ⓑ 10 EA. 1.5"X3.5"X19.9"
Ⓒ 20 EA. 1.5"X3.5"X36.5"
Ⓓ 20 EA. .5 PLYWOOD GUSSETS

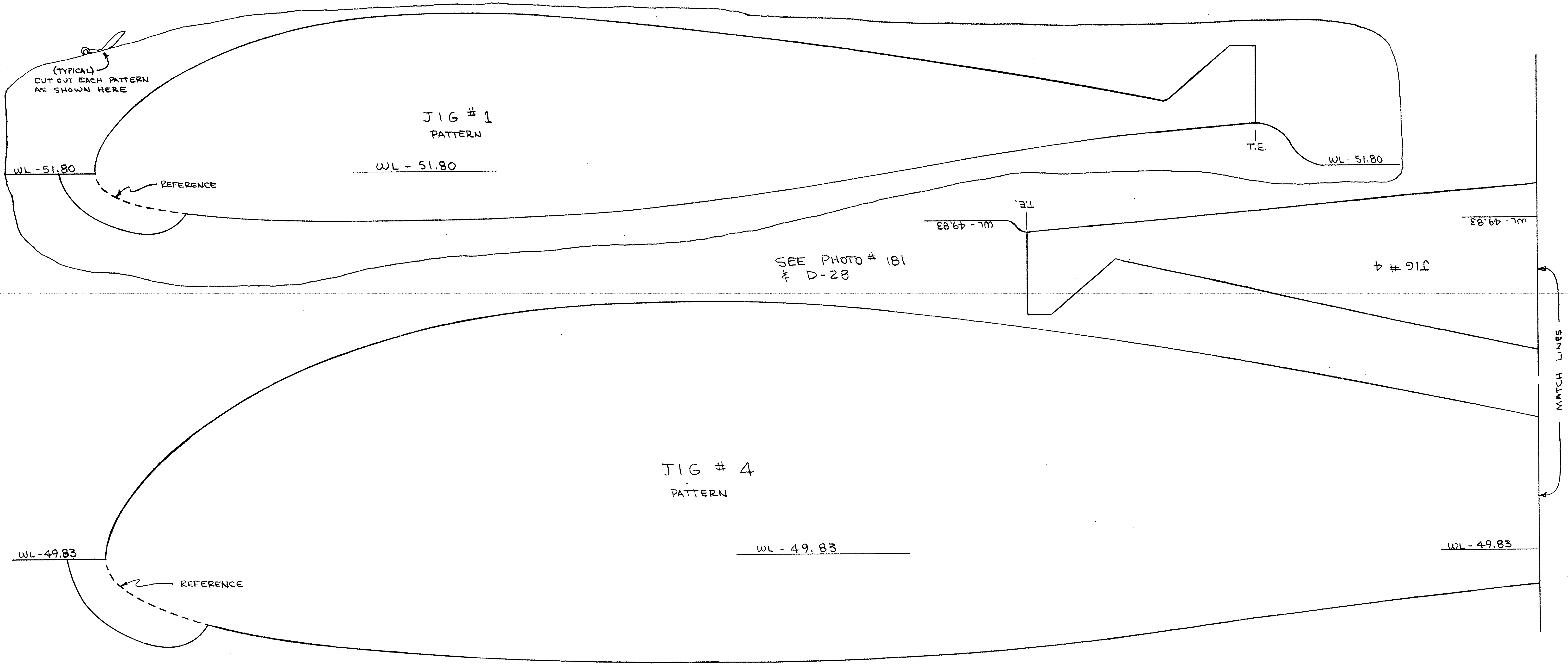


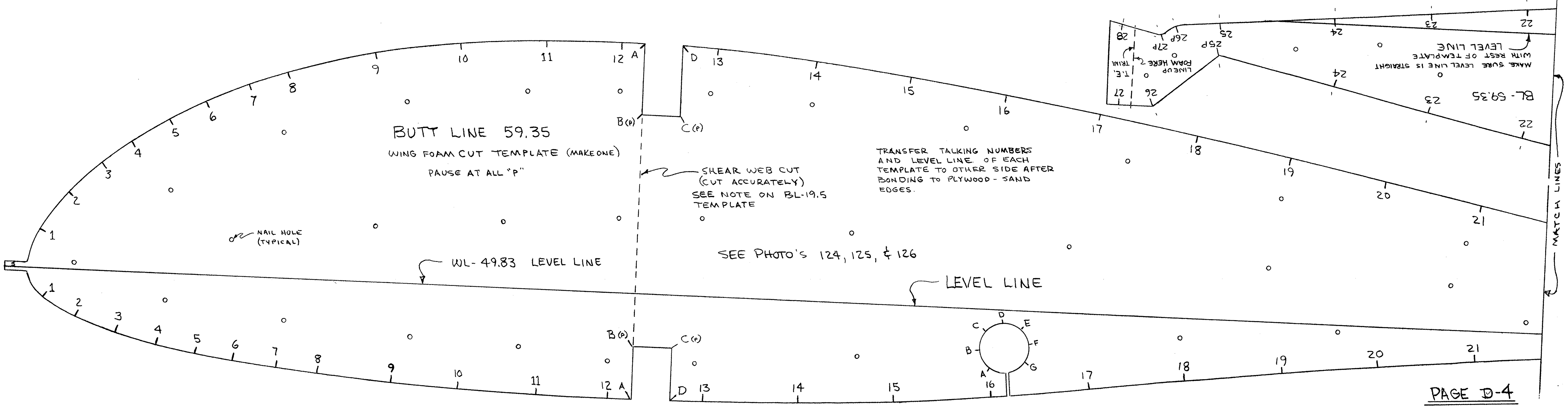
CANARD TIP "OUTBOARD PANEL"
BUTT LINE 145
(MAKE ONE)
WL-49.2 LEVEL LINE
TRANSFER TALK NUMBERS & LEVEL LINE TO OTHER SIDE
LINE UP FOAM HERE
T.E.
CANARD
BUTT LINE 110
(MAKE ONE) "OUTBOARD PANEL"
TRANSFER TALK NUMBERS & LEVEL LINE TO OTHER SIDE
WL-49.2 LEVEL LINE
CANARD ELEVATOR TEMPLATE (MAKE TWO)
CANARD
BUTT LINE 110
(MAKE ONE)
SHEAR WEB CUT (CUT ACCURATELY)
CONDUIT IN FOAM FOR PITOT & STATIC PLUS VOR COAX
WL-49.2 LEVEL LINE
BL 112.85
AILERON HOT WIRE TEMPLATE (MAKE ONE)
NAIL HOLE (TYP)
TRANSFER TALK NUMBERS TO OTHER SIDE
CANARD
BUTT LINE 65
(MAKE ONE)
SHEAR WEB CUT (CUT ACCURATELY)
WL-49.2 LEVEL LINE
TEMPLATE TO POSITION CS-4 PLUG IN ELEVATOR. TRANSFER THIS PATTERN TO THIN PLYWOOD OR ALUM. SHEET (MAKE ONE)
BL 59.35
AILERON HOT WIRE TEMPLATE (MAKE ONE)
TRANSFER TALK NUMBERS TO OTHER SIDE
NAIL HOLE (TYP)
CANARD
BUTT LINE +20 & -20
(MAKE TWO)
SHEAR WEB CUT (CUT ACCURATELY)
TRANSFER TALK NUMBERS & LEVEL LINE TO OTHERSIDE
WL-49.2 LEVEL LINE
BL-19.5
AILERON HOT WIRE TEMPLATE (MAKE ONE)
TRANSFER TALK NUMBERS TO OTHER SIDE
ELEVATOR COUNTER WEIGHT JIG (MAKE ONE) 1/4" PLYWOOD
FWD
ELEVATOR TO CANARD JIG TEMPLATE (MAKE TWO) 1/4" PLYWOOD
FWD.
BUTT LINE +110 & -110
ELEVATOR TO CANARD JIG TEMPLATE (MAKE TWO) 1/4" PLYWOOD
BUTT LINE +20 & -20
FWD

SEE PHOTO'S 124, 125, 126, & 82, 83.


MAIN WING
BUTT LINE 19.5
WING FOAM CUT TEMPLATE
(MAKE ONE)
PAUSE AT ALL "P"
FWD. FACE OF SHEAR WEB.
NOTE: THIS LINE WILL BE CUT AFTER REMOVING TEMPLATE BL-59.35 AND CAREFULLY PLACING STRAIGHT EDGE ON EACH END OF FOAM BLOCK AND ALIGNING THEM WITH FWD. FACE OF SHEAR WEB. THEN MAKE HOT WIRE CUT.
LEVEL LINE
WL-49 LEVEL LINE
LINE UP FOAM HERE
T.E. TRIM
FOAM CONDUIT FOR WING TIP STROBES & ANTENNA COAX
NAIL HOLE (TYP)
SPAR CAP BRIDGE TEMPLATE BL-59.35
USE AIRFOIL TEMPLATE BL-59.35 TO PATTERN EACH NAIL HOLE (6 PLACES)
SPAR CAP OUTLINE
FWD
UP
TOP
SPAR CAP BRIDGE TEMPLATE BL-180
USE AIRFOIL TEMPLATE TO PATTERN EA. NAIL HOLE
MAIN WING
BUTT LINE 112.85
WING FOAM CUT TEMPLATE (MAKE ONE)
PAUSE AT ALL "P"
WL-50.712 LEVEL LINE
SHEAR WEB CUT (CUT ACCURATELY)
NAIL HOLE (TYP.)
TRANSFER TALK NUMBERS AND LEVEL LINE OF EACH TEMPLATE TO OTHER SIDE AFTER BONDING TO PLYWOOD - SAND EDGES
SPAR CAP BRIDGE TEMPLATE BL-146.43
USE AIRFOIL TEMPLATE TO PATTERN EACH NAIL HOLE (6 PLACES)
MAIN WING
BUTT LINE 146.43
WING FOAM CUT TEMPLATE
PAUSE AT ALL "P"
(MAKE ONE)
WL-51.256 LEVEL LINE
SHEAR WEB CUT (CUT ACCURATELY)
NAIL HOLE (TYP)
BUTT LINE 180
NAIL HOLE (TYPICAL)
SHEAR WEB CUT (CUT ACCURATELY)
MAIN WING
WING FOAM CUT TEMPLATE (MAKE ONE)
WL-51.80 LEVEL LINE
LEVEL LINE
SPAR CAP BRIDGE TEMPLATE BL-112.85
USE AIRFOIL TEMPL. TO PATTERN EACH NAIL HOLE (6 PLACES)
SPAR CAP OUTLINE
A
B(P)
C(P)
D
E
F
G
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
25P
26
26P
27
27P
28

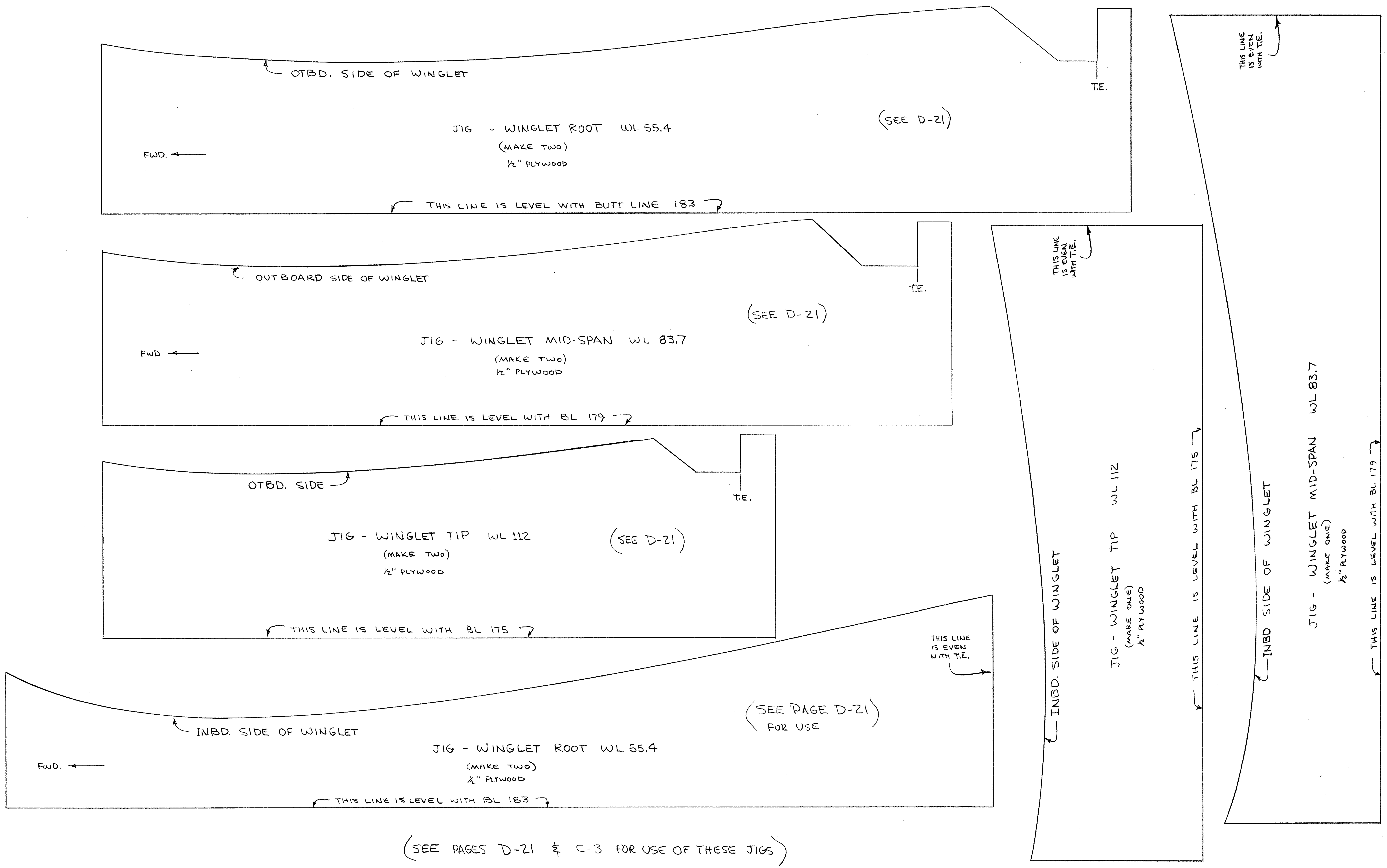
SEE PHOTO' 124, 125, & 126


(TYPICAL) CUT OUT EACH PATTERN AS SHOWN HERE
JIG # 1
PATTERN
WL - 51.80
WL - 51.80
WL - 51.80
T.E.
REFERENCE
SEE PHOTO # 181 & D-28
T.E.
WL - 49.83
WL - 49.83
JIG # 4
MATCH LINES
JIG # 4
PATTERN
WL - 49.83
WL - 49.83
WL - 49.83
REFERENCE

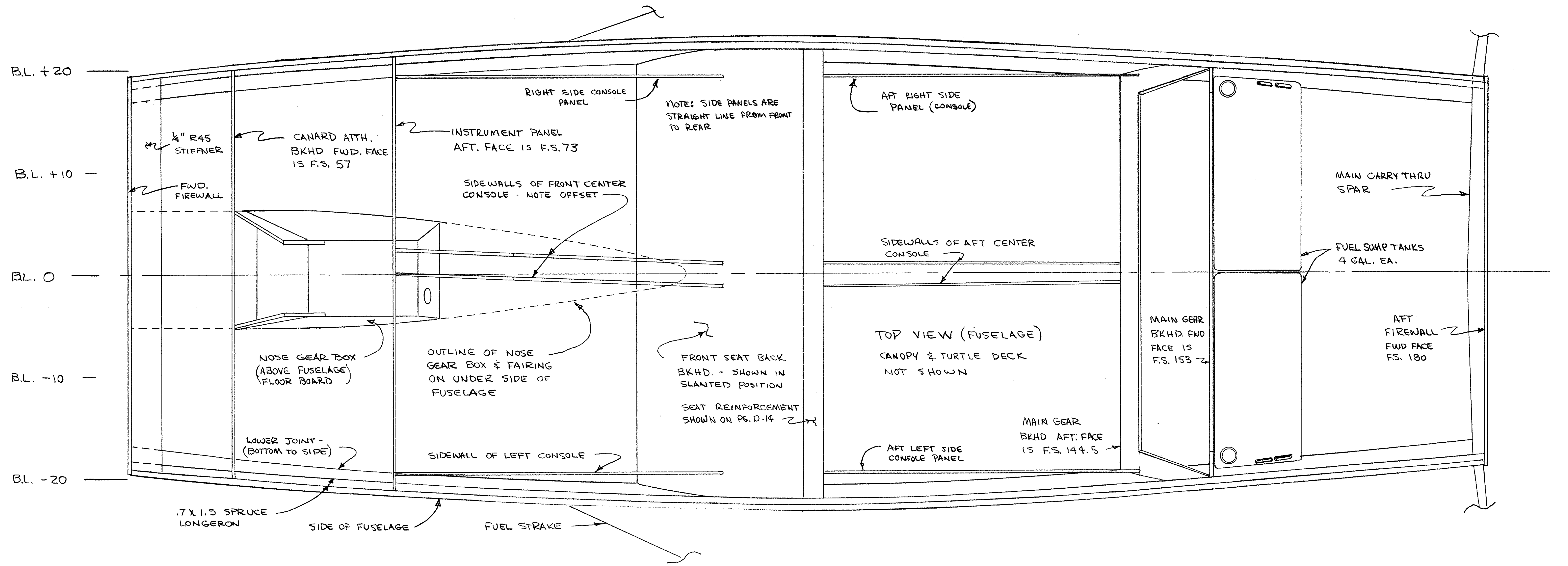

BUTT LINE 59.35
WING FOAM CUT TEMPLATE (MAKE ONE)
PAUSE AT ALL "P"
NAIL HOLE (TYPICAL)
WL - 49.83 LEVEL LINE
SHEAR WEB CUT (CUT ACCURATELY)
SEE NOTE ON BL-19.5 TEMPLATE
TRANSFER TALKING NUMBERS AND LEVEL LINE OF EACH TEMPLATE TO OTHER SIDE AFTER BONDING TO PLYWOOD - SAND EDGES.
SEE PHOTO'S 124, 125, & 126
LEVEL LINE
A
B(P)
C(P)
D
E
F
G
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
25P
26
26P
27
27P
28
BL - 59.35
MAKE SURE LEVEL LINE IS STRAIGHT WITH REST OF TEMPLATE
LEVEL LINE
LINE UP FOAM HERE
T.E.
TRIM
MATCH LINES

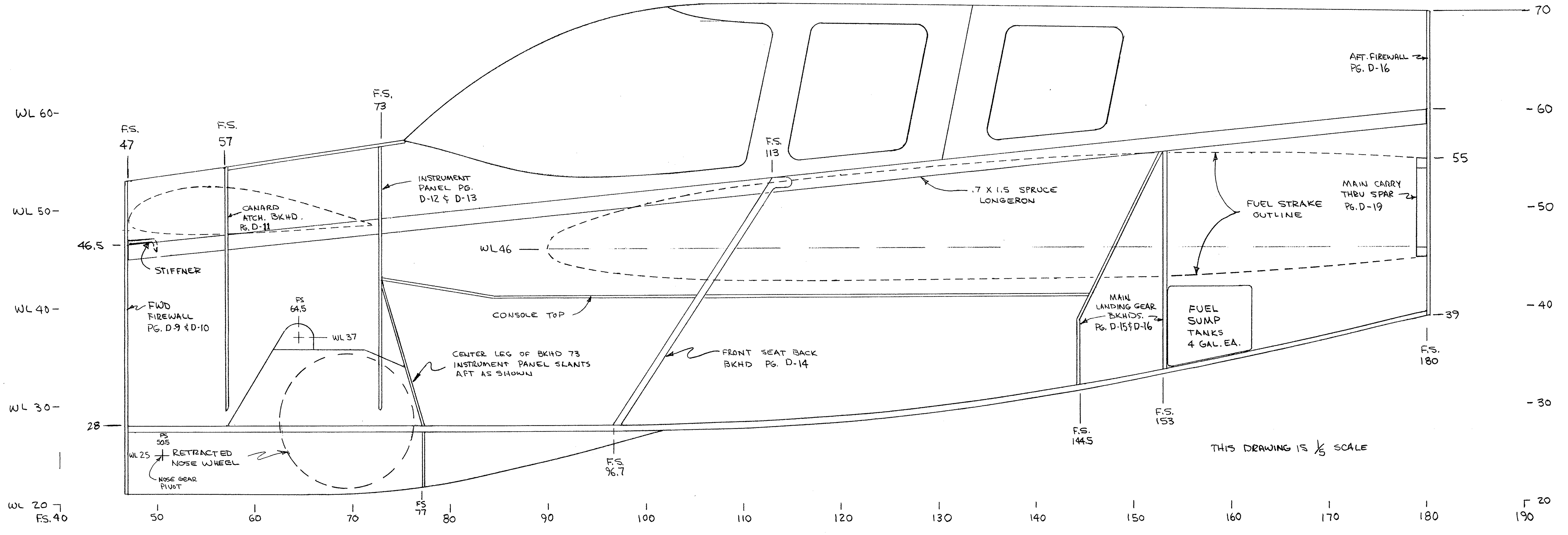
SEE PHOTO # 181
& D-28

(TYPICAL) CUT OUT EACH PATTERN AS SHOWN HERE
JIG # 1 & # 6
(BL-110 & BL+110)
(SEE D-23 FOR USE)
WL-49.2
REFERENCE
T.E.
WL-49.2
WL-49.2
JIG # 2 & # 5
(BL-65 & BL+65)
(SEE D-23 FOR USE)
WL-49.2
T.E.
WL-49.2
WL-49.2
JIG # 3 & # 4
(BL-20 & BL+20)
(SEE D-23 FOR USE)
WL-49.2
REFERENCE
T.E.
WL-49.2
WL-49.2
LEVEL LINE
BL-145 & BL+145
TOP
MATCH THESE LINES
TOP
CANARD FOAM CORE SUPPORT
BL-145 & BL+145
(MAKE TWO)
1/2" PLYWOOD
(SEE PHOTO 157)
LEVEL LINE
MAX. 20°
18
16
14
10
5
0
5
10
MAX. 12°
WL-49.2
WL 49.2
(MAKE ONE)
1/2" PLYWOOD
20° DOWN ELEVATOR (MAX.)
12° UP ELEVATOR (MAX.)
USE AT BL-65 OR BL+65
ELEVATOR TRAVEL TEMPLATE
L.E.
T.E.
SPAR CAP LOCATION
SEE PHOTO # 476
LEVEL LINE
THIS LINE IS LEVEL WITH WL-49.2


OTBD. SIDE OF WINGLET
T.E.
(SEE D-21)
JIG - WINGLET ROOT WL 55.4
(MAKE TWO)
½" PLYWOOD
FWD.
THIS LINE IS LEVEL WITH BUTT LINE 183
OUTBOARD SIDE OF WINGLET
T.E.
(SEE D-21)
JIG - WINGLET MID-SPAN WL 83.7
(MAKE TWO)
½" PLYWOOD
FWD
THIS LINE IS LEVEL WITH BL 179
OTBD. SIDE
T.E.
JIG - WINGLET TIP WL 112
(MAKE TWO)
½" PLYWOOD
(SEE D-21)
THIS LINE IS LEVEL WITH BL 175
THIS LINE IS EVEN WITH T.E.
(SEE PAGE D-21 FOR USE)
INBD. SIDE OF WINGLET
JIG - WINGLET ROOT WL 55.4
(MAKE TWO)
½" PLYWOOD
FWD.
THIS LINE IS LEVEL WITH BL 183
THIS LINE IS EVEN WITH T.E.
INBD. SIDE OF WINGLET
JIG - WINGLET TIP WL 112
(MAKE ONE)
½" PLYWOOD
THIS LINE IS LEVEL WITH BL 175
THIS LINE IS EVEN WITH T.E.
INBD SIDE OF WINGLET
JIG - WINGLET MID-SPAN WL 83.7
(MAKE ONE)
½" PLYWOOD
THIS LINE IS LEVEL WITH BL 179

(SEE PAGES D-21 & C-3 FOR USE OF THESE JIGS)


B.L. +20
B.L. +10
B.L. 0
B.L. -10
B.L. -20
1/4" R45 STIFFNER
CANARD ATTH. BKHD FWD. FACE IS F.S. 57
FWD. FIREWALL
RIGHT SIDE CONSOLE PANEL
INSTRUMENT PANEL AFT. FACE IS F.S.73
NOTE: SIDE PANELS ARE STRAIGHT LINE FROM FRONT TO REAR
AFT RIGHT SIDE PANEL (CONSOLE)
SIDEWALLS OF FRONT CENTER CONSOLE - NOTE OFFSET
MAIN CARRY THRU SPAR
SIDEWALLS OF AFT CENTER CONSOLE
FUEL SUMP TANKS 4 GAL. EA.
NOSE GEAR BOX (ABOVE FUSELAGE FLOOR BOARD)
OUTLINE OF NOSE GEAR BOX & FAIRING ON UNDER SIDE OF FUSELAGE
FRONT SEAT BACK BKHD. - SHOWN IN SLANTED POSITION
SEAT REINFORCEMENT SHOWN ON PG. D-14
TOP VIEW (FUSELAGE)
CANOPY & TURTLE DECK NOT SHOWN
MAIN GEAR BKHD. FWD FACE IS F.S. 153
AFT FIREWALL FWD FACE F.S. 180
MAIN GEAR BKHD AFT. FACE IS F.S. 144.5
LOWER JOINT - (BOTTOM TO SIDE)
SIDEWALL OF LEFT CONSOLE
AFT LEFT SIDE CONSOLE PANEL
.7 X 1.5 SPRUCE LONGERON
SIDE OF FUSELAGE
FUEL STRAKE



THIS DRAWING IS 1/5 SCALE

NOTE:
DRILL 1/16" PILOT HOLE THRU BKHD TO IDENTIFY MOUNT LOCATIONS DURING CONSTRUCTION

BKHD F.S. 47

AFT FACE (LEFT SIDE)
BKHD F.S. 47 FWD. FIREWALL
1/4" BIRCH AIRCRAFT PLYWOOD
1 PLY BID @ 45° ON EACH SIDE

NOTE: AFT FACE THIS BKHD IS F.S. 47

PAGE D-9 (LEFT)
SEE PAGE D-10 FOR OTHER HALF (RIGHT)
(FULL SIZE)

SEE PHOTO' # 1
C-1
& # 319 C-8

WITH INK PEN MARK THESE LINES ON BOTH SIDES

NOTE: DRILL 1/16" PILOT HOLE THRU BKHD TO IDENTIFY MOUNT LOCATIONS DURING CONSTRUCTION

BKHD F.S. 47

AFT FACE (RIGHT SIDE)
BKHD F.S. 47 FWD. FIREWALL
1/4" BIRCH AIRCRAFT PLYWOOD

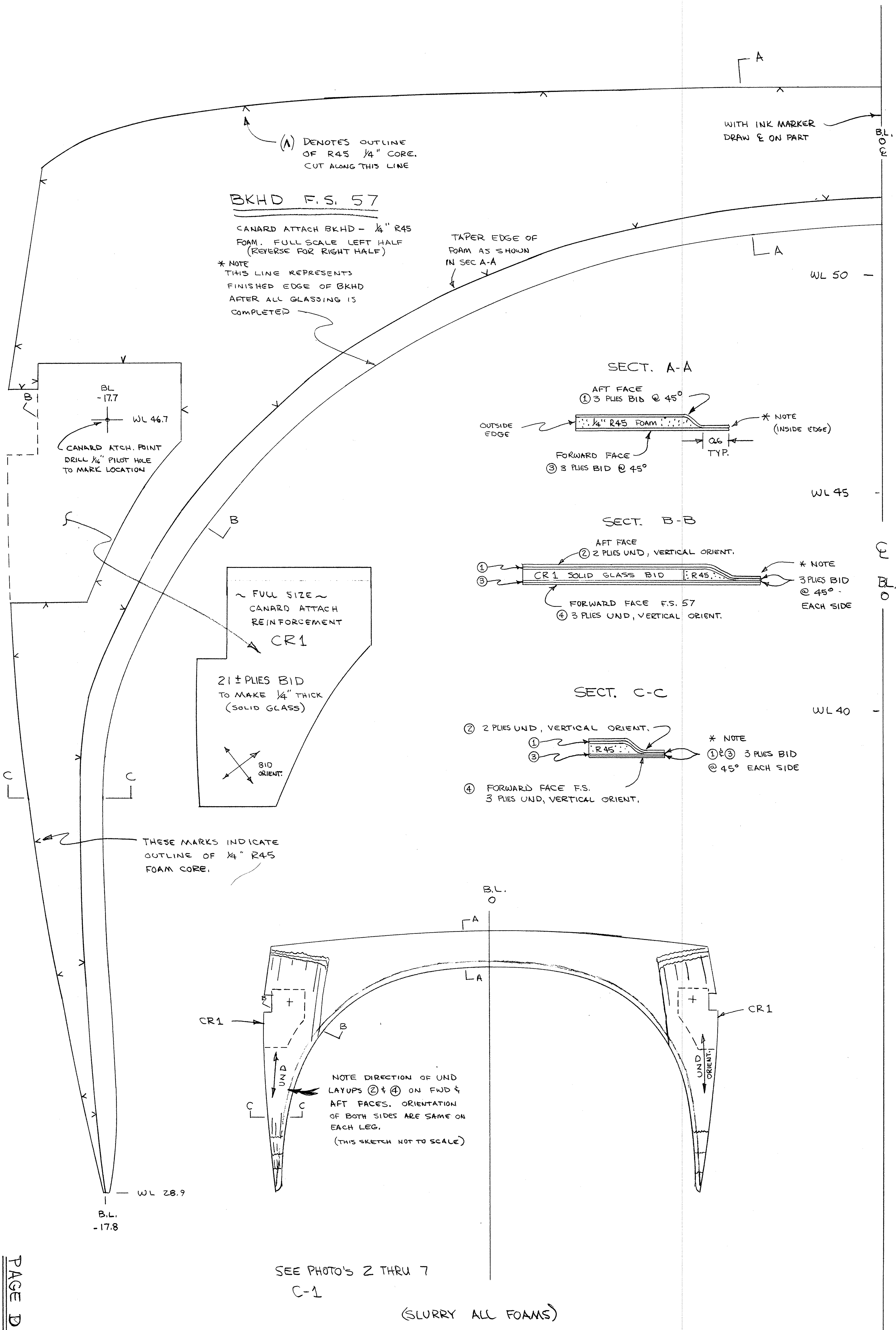
1 PLY BID @ 45° ON EACH SIDE

NOTE: AFT FACE THIS BKHD IS F.S. 47

PAGE D-10 (RIGHT)
SEE PAGE D-9 FOR OTHER HALF (LEFT)
(FULL SIZE)

WITH INK PEN MARK CENTER LINE (BL-'0') ON BOTH SIDES OF FIREWALL

NOTE: NOSE GEAR BOX IS OFF SET TO RIGHT - BUT ENTIRE NOSE GEAR, WHEEL & RETRACT MECHANISM IS OFF SET TO THE LEFT



BKHD F.S. 57

CANARD ATTACH BKHD – ¼" R45 FOAM. FULL SCALE LEFT HALF (REVERSE FOR RIGHT HALF)

* NOTE
THIS LINE REPRESENTS FINISHED EDGE OF BKHD AFTER ALL GLASSING IS COMPLETED

(Λ) DENOTES OUTLINE OF R45 ¼" CORE. CUT ALONG THIS LINE

WITH INK MARKER DRAW ℄ ON PART

TAPER EDGE OF FOAM AS SHOWN IN SEC A-A

CANARD ATCH. POINT DRILL 1/16" PILOT HOLE TO MARK LOCATION

~ FULL SIZE ~ CANARD ATTACH REINFORCEMENT CR1

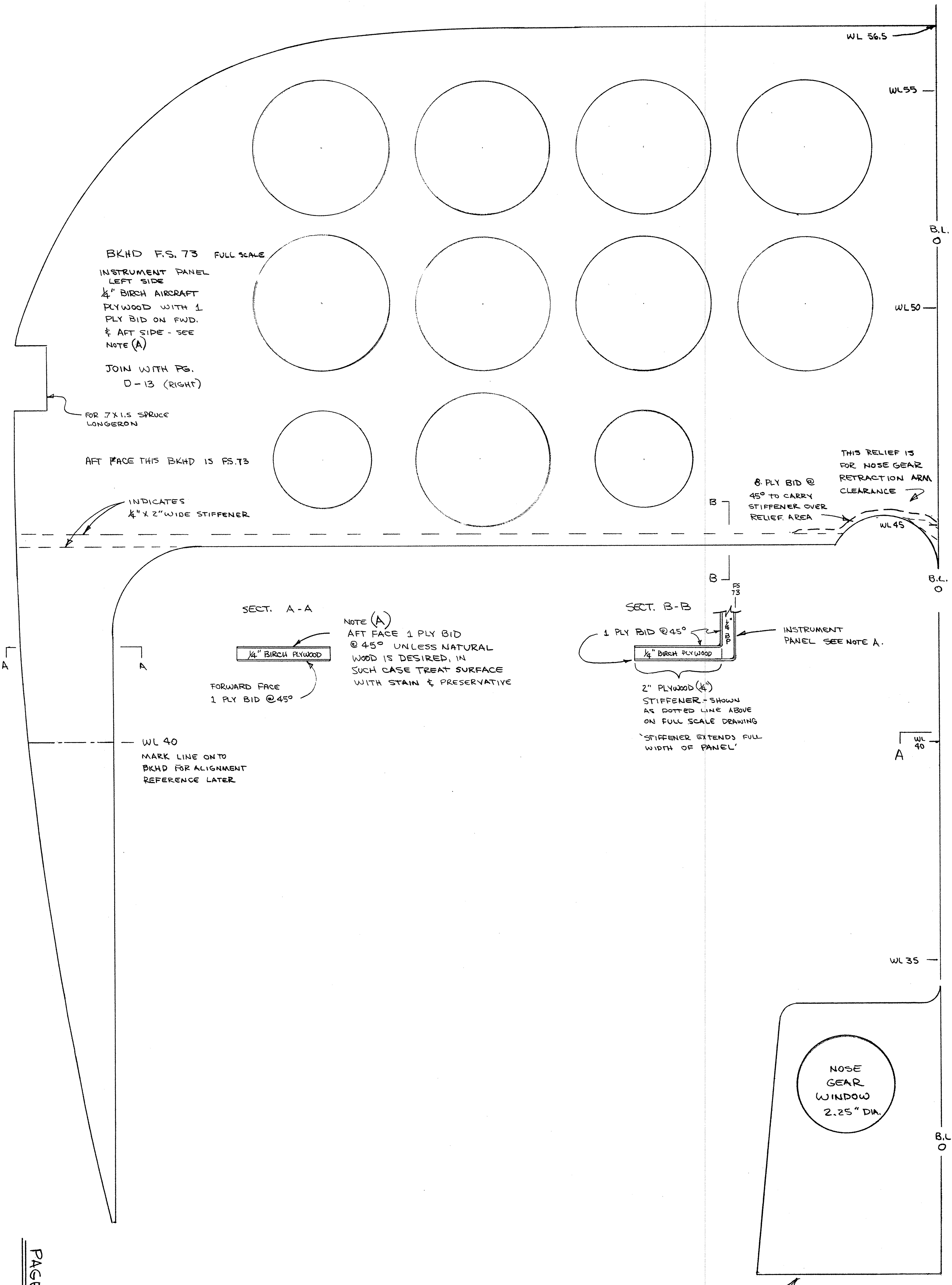
21 ± PLIES BID TO MAKE ¼" THICK (SOLID GLASS)

THESE MARKS INDICATE OUTLINE OF ¼" R45 FOAM CORE.

NOTE DIRECTION OF UND LAYUPS ② & ④ ON FWD & AFT FACES. ORIENTATION OF BOTH SIDES ARE SAME ON EACH LEG. (THIS SKETCH NOT TO SCALE)

SEE PHOTO'S 2 THRU 7 C-1

(SLURRY ALL FOAMS)



BKHD F.S. 73 FULL SCALE

INSTRUMENT PANEL LEFT SIDE ¼" BIRCH AIRCRAFT PLYWOOD WITH 1 PLY BID ON FWD. & AFT SIDE - SEE NOTE (A)

JOIN WITH PG. D-13 (RIGHT)

FOR .7 X 1.5 SPRUCE LONGERON

AFT FACE THIS BKHD IS F.S. 73

INDICATES ¼" X 2" WIDE STIFFENER

8 PLY BID @ 45° TO CARRY STIFFENER OVER RELIEF AREA

THIS RELIEF IS FOR NOSE GEAR RETRACTION ARM CLEARANCE

SECT. A-A

NOTE (A) AFT FACE 1 PLY BID @ 45° UNLESS NATURAL WOOD IS DESIRED, IN SUCH CASE TREAT SURFACE WITH STAIN & PRESERVATIVE

FORWARD FACE 1 PLY BID @45°

SECT. B-B

1 PLY BID @45°

INSTRUMENT PANEL SEE NOTE A.

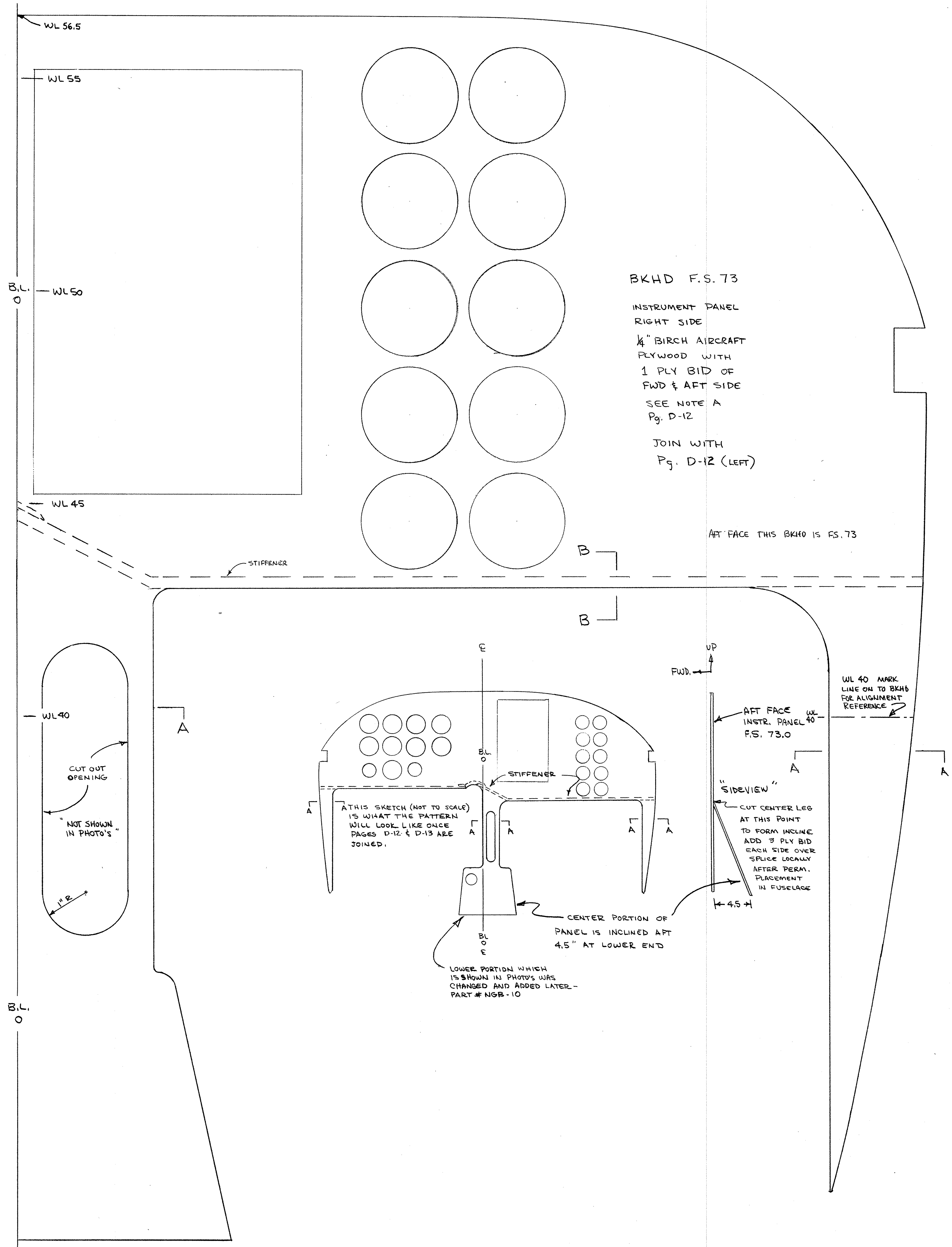
2" PLYWOOD (¼") STIFFENER - SHOWN AS DOTTED LINE ABOVE ON FULL SCALE DRAWING

'STIFFENER EXTENDS FULL WIDTH OF PANEL'

WL 40 MARK LINE ONTO BKHD FOR ALIGNMENT REFERENCE LATER

NOSE GEAR WINDOW 2.25" DIA.

LOWER PORTION SHOWN IN PHOTO #292 IS ADDED IN PLANS AS PART NGB-10



BKHD F.S. 73

INSTRUMENT PANEL
RIGHT SIDE
1/4" BIRCH AIRCRAFT
PLYWOOD WITH
1 PLY BID OF
FWD & AFT SIDE
SEE NOTE A
Pg. D-12

JOIN WITH
Pg. D-12 (LEFT)

AFT FACE THIS BKHD IS F.S. 73

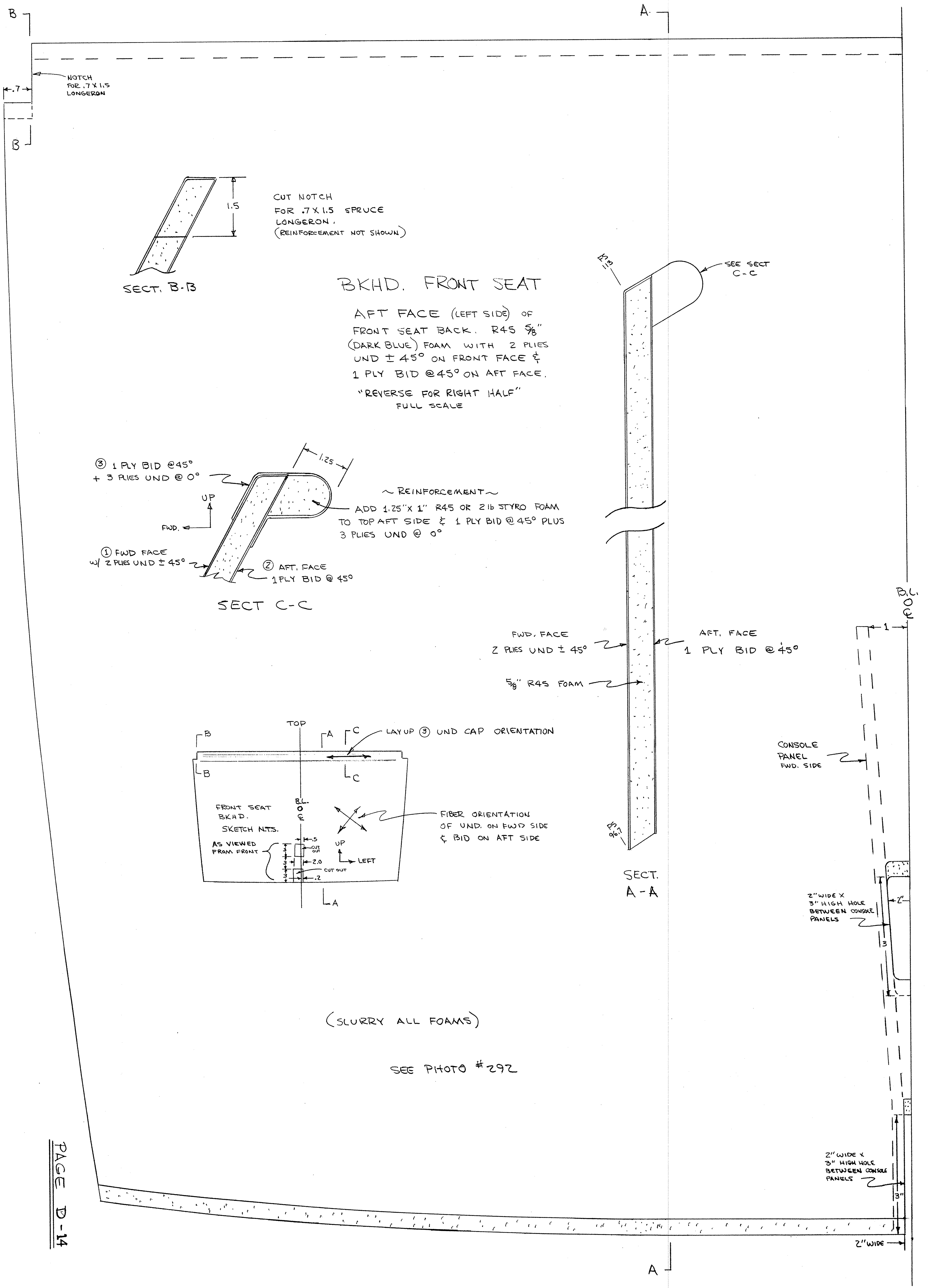
THIS SKETCH (NOT TO SCALE) IS WHAT THE PATTERN WILL LOOK LIKE ONCE PAGES D-12 & D-13 ARE JOINED.

CUT CENTER LEG AT THIS POINT TO FORM INCLINE ADD 3 PLY BID EACH SIDE OVER SPLICE LOCALLY AFTER PERM. PLACEMENT IN FUSELAGE

CENTER PORTION OF PANEL IS INCLINED AFT 4.5" AT LOWER END

LOWER PORTION WHICH IS SHOWN IN PHOTO'S WAS CHANGED AND ADDED LATER - PART # NGB-10

WL 40 MARK LINE ON TO BKHD FOR ALIGNMENT REFERENCE


B
B
.7
NOTCH FOR .7 X 1.5 LONGERON
A
A
1.5
SECT. B-B
FS 113
SEE SECT C-C
③ 1 PLY BID @45° + 3 PLIES UND @ 0°
1.25
~ REINFORCEMENT ~
ADD 1.25" X 1" R45 OR 2 lb STYRO FOAM TO TOP AFT SIDE & 1 PLY BID @ 45° PLUS 3 PLIES UND @ 0°
UP
FWD.
① FWD FACE w/ 2 PLIES UND ± 45°
② AFT. FACE 1 PLY BID @ 45°
SECT C-C
FWD. FACE 2 PLIES UND ± 45°
AFT. FACE 1 PLY BID @ 45°
5/8" R45 FOAM
FS 96.7
SECT. A-A
TOP
B
A
C
LAY UP ③ UND CAP ORIENTATION
B
C
FRONT SEAT BKHD.
SKETCH N.T.S.
B.L. 0 ℄
AS VIEWED FROM FRONT
.5
CUT OUT
3
3
3
2.0
CUT OUT
.2
UP
LEFT
FIBER ORIENTATION OF UND. ON FWD SIDE & BID ON AFT SIDE
A
B.L. 0 ℄
1
CONSOLE PANEL FWD. SIDE
2" WIDE X 3" HIGH HOLE BETWEEN CONSOLE PANELS
2"
3
2" WIDE X 3" HIGH HOLE BETWEEN CONSOLE PANELS
3"
2" WIDE

CUT NOTCH
FOR .7 X 1.5 SPRUCE
LONGERON.
(REINFORCEMENT NOT SHOWN)

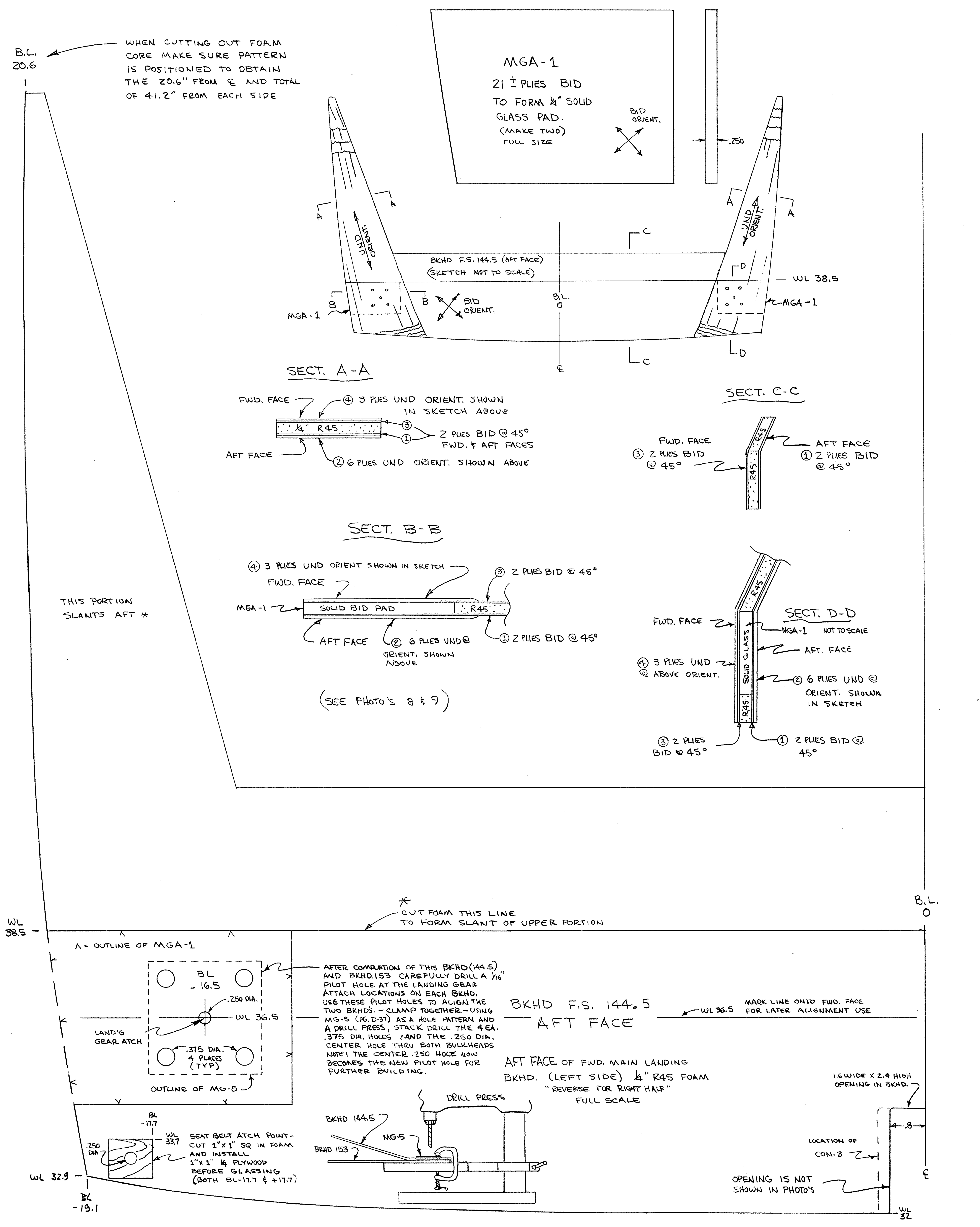
BKHD. FRONT SEAT

AFT FACE (LEFT SIDE) OF
FRONT SEAT BACK. R45 5/8"
(DARK BLUE) FOAM WITH 2 PLIES
UND ± 45° ON FRONT FACE &
1 PLY BID @45° ON AFT FACE.

"REVERSE FOR RIGHT HALF"
FULL SCALE

(SLURRY ALL FOAMS)

SEE PHOTO #292



WHEN CUTTING OUT FOAM CORE MAKE SURE PATTERN IS POSITIONED TO OBTAIN THE 20.6" FROM ℄ AND TOTAL OF 41.2" FROM EACH SIDE

(SEE PHOTO'S 8 & 9)

THIS PORTION SLANTS AFT *

* CUT FOAM THIS LINE TO FORM SLANT OF UPPER PORTION

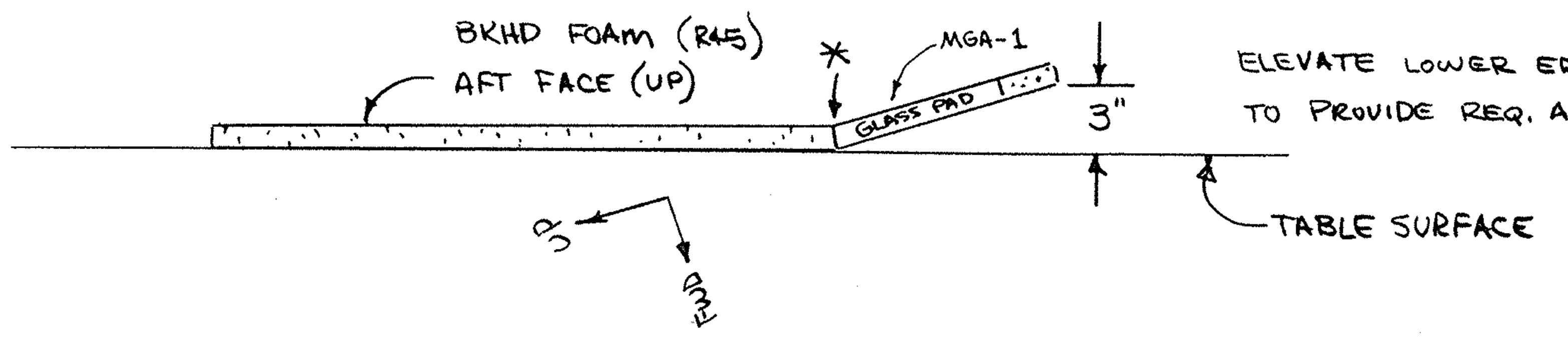
AFTER COMPLETION OF THIS BKHD (144.5) AND BKHD. 153 CAREFULLY DRILL A 1/16" PILOT HOLE AT THE LANDING GEAR ATTACH LOCATIONS ON EACH BKHD. USE THESE PILOT HOLES TO ALIGN THE TWO BKHD'S. – CLAMP TOGETHER – USING MG-5 (PG. D-37) AS A HOLE PATTERN AND A DRILL PRESS, STACK DRILL THE 4 EA. .375 DIA. HOLES (AND THE .250 DIA. CENTER HOLE THRU BOTH BULKHEADS NOTE! THE CENTER .250 HOLE NOW BECOMES THE NEW PILOT HOLE FOR FURTHER BUILDING.

MARK LINE ONTO FWD. FACE FOR LATER ALIGNMENT USE

AFT FACE OF FWD. MAIN LANDING BKHD. (LEFT SIDE) ¼" R45 FOAM
"REVERSE FOR RIGHT HALF"
FULL SCALE

SEAT BELT ATCH POINT – CUT 1"x1" SQ IN FOAM AND INSTALL 1"x1" ¼ PLYWOOD BEFORE GLASSING (BOTH BL-17.7 & +17.7)

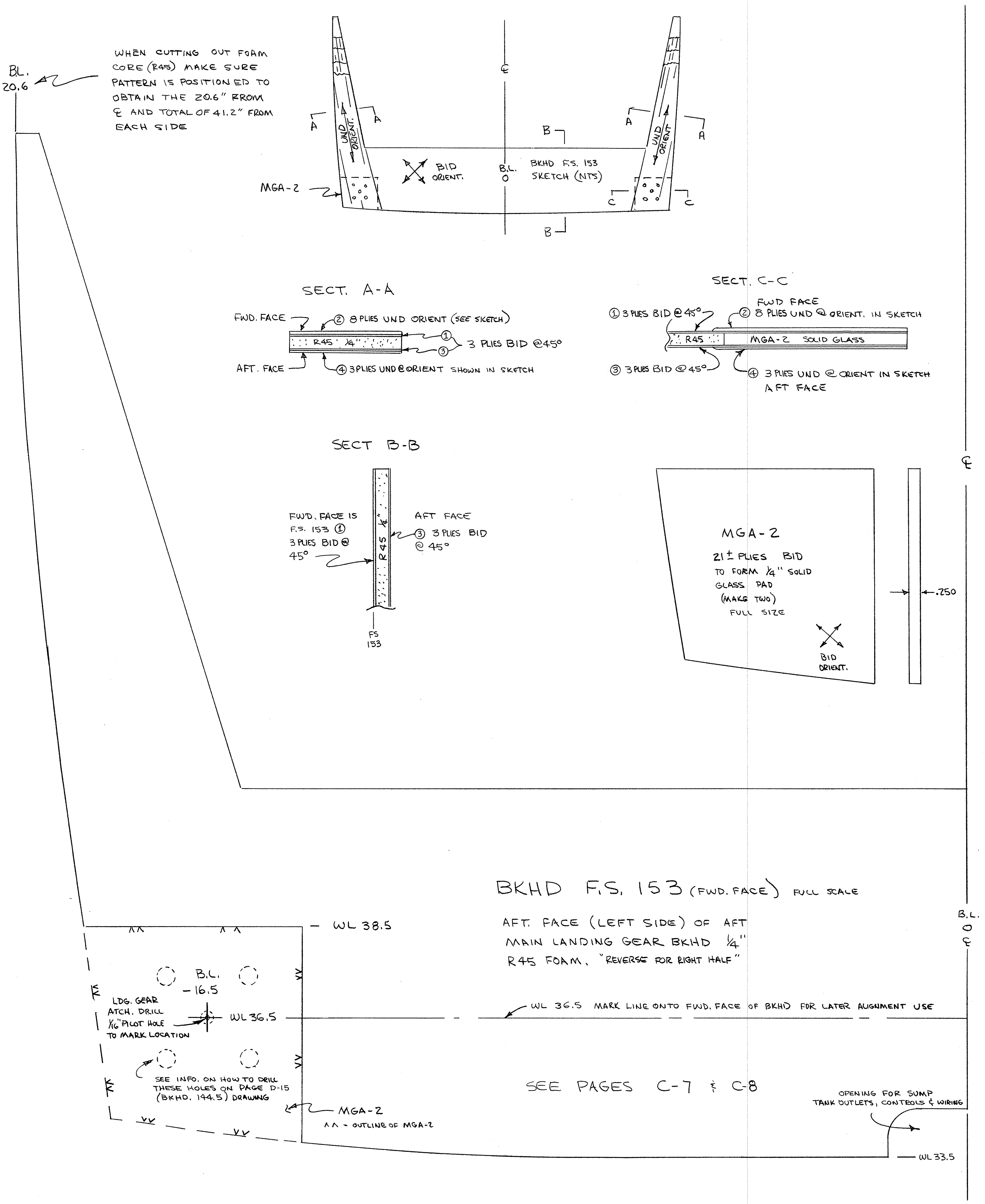
OPENING IS NOT SHOWN IN PHOTO'S



ELEVATE LOWER EDGE OF BKHD 3" TO PROVIDE REQ. ANGLE – DO LAYUPS ① & ② WHILE IN THIS POSITION

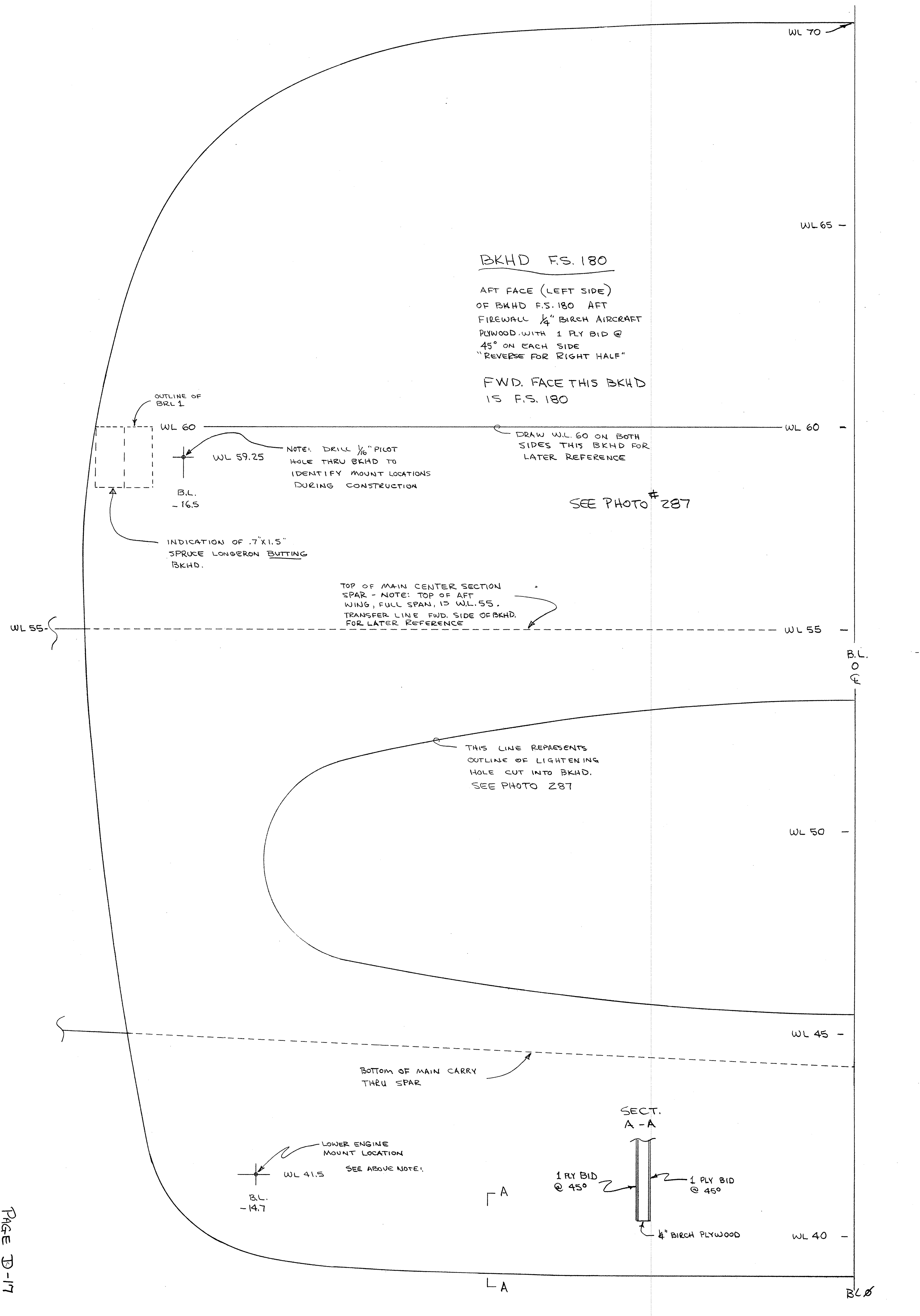
(SEE PHOTO'S 8, 9, & 289)

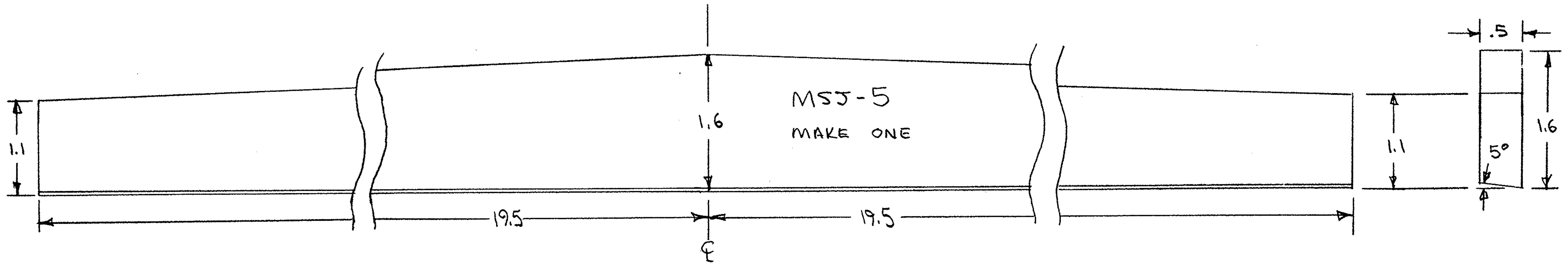
(SLURRY ALL FOAMS)

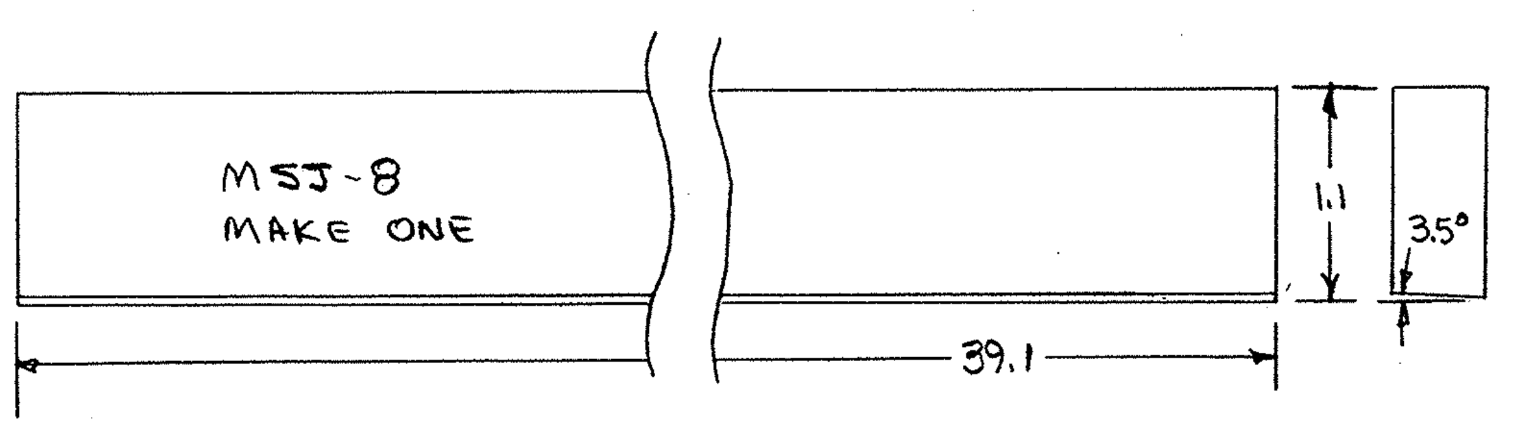


BL.
20.6
WHEN CUTTING OUT FOAM CORE (R45) MAKE SURE PATTERN IS POSITIONED TO OBTAIN THE 20.6" FROM ℄ AND TOTAL OF 41.2" FROM EACH SIDE
℄
A
A
A
A
B
B
UND ORIENT.
UND ORIENT.
BID ORIENT.
B.L. 0
BKHD F.S. 153 SKETCH (NTS)
MGA-2
C
C
SECT. A-A
FWD. FACE
② 8 PLIES UND ORIENT (SEE SKETCH)
①
R45 ¼"
③
3 PLIES BID @45°
AFT. FACE
④ 3 PLIES UND @ ORIENT SHOWN IN SKETCH
SECT. C-C
FWD FACE
① 3 PLIES BID @ 45°
② 8 PLIES UND @ ORIENT. IN SKETCH
R45
MGA-2 SOLID GLASS
③ 3 PLIES BID @ 45°
④ 3 PLIES UND @ ORIENT IN SKETCH
AFT FACE
SECT B-B
FWD. FACE IS F.S. 153 ① 3 PLIES BID @ 45°
AFT FACE
③ 3 PLIES BID @ 45°
R45 ¼"
FS 153
MGA-2
21± PLIES BID TO FORM ¼" SOLID GLASS PAD (MAKE TWO) FULL SIZE
BID ORIENT.
.250
℄
BKHD F.S. 153 (FWD. FACE) FULL SCALE
AFT. FACE (LEFT SIDE) OF AFT MAIN LANDING GEAR BKHD ¼" R45 FOAM. "REVERSE FOR RIGHT HALF"
B.L. 0 ℄
WL 38.5
B.L. -16.5
LDG. GEAR ATCH. DRILL 1/16" PILOT HOLE TO MARK LOCATION
WL 36.5
WL 36.5 MARK LINE ONTO FWD. FACE OF BKHD FOR LATER ALIGNMENT USE
SEE INFO. ON HOW TO DRILL THESE HOLES ON PAGE D-15 (BKHD. 144.5) DRAWING
MGA-2
ΛΛ - OUTLINE OF MGA-2
SEE PAGES C-7 & C-8
OPENING FOR SUMP TANK OUTLETS, CONTROLS & WIRING
WL 33.5
BL 0 ℄

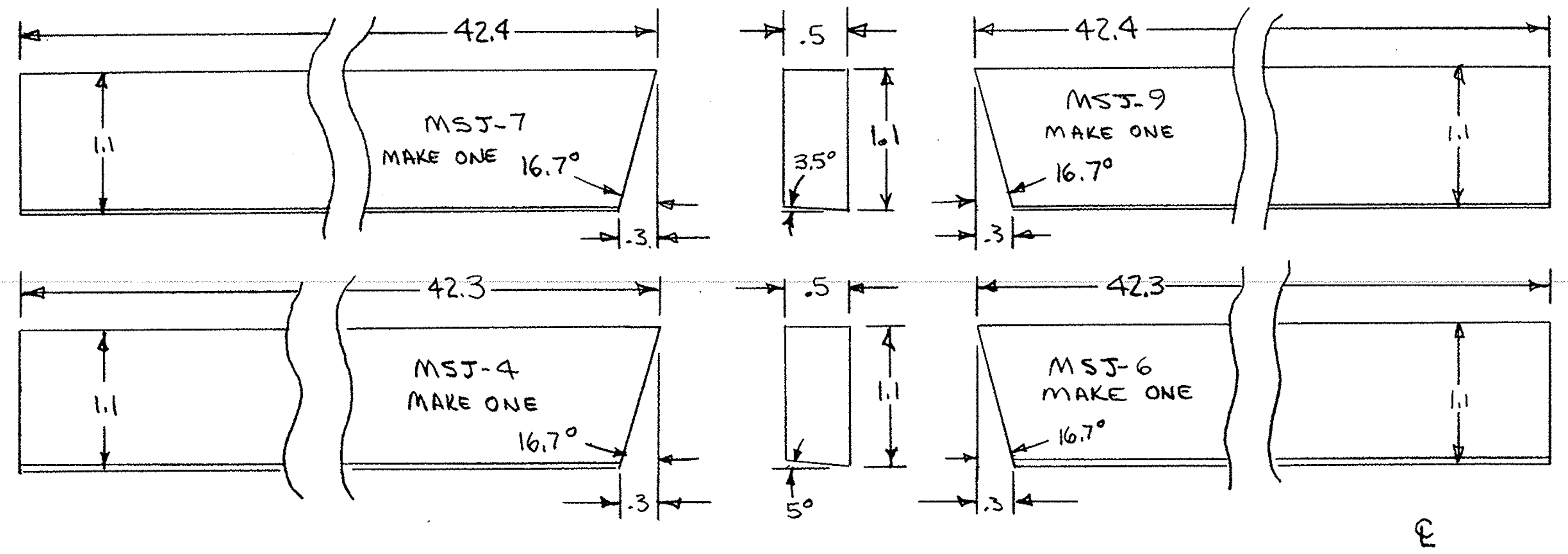
(SLURRY ALL FOAMS)


WL 70
WL 65 –
BKHD F.S. 180
AFT FACE (LEFT SIDE)
OF BKHD F.S. 180 AFT
FIREWALL 1/4" BIRCH AIRCRAFT
PLYWOOD. WITH 1 PLY BID @
45° ON EACH SIDE
"REVERSE FOR RIGHT HALF"
FWD. FACE THIS BKHD
IS F.S. 180
OUTLINE OF
BRL 1
WL 60
NOTE: DRILL 1/16" PILOT
HOLE THRU BKHD TO
IDENTIFY MOUNT LOCATIONS
DURING CONSTRUCTION
WL 59.25
B.L.
-16.5
DRAW W.L. 60 ON BOTH
SIDES THIS BKHD FOR
LATER REFERENCE
WL 60 –
SEE PHOTO # 287
INDICATION OF .7"X1.5"
SPRUCE LONGERON BUTTING
BKHD.
TOP OF MAIN CENTER SECTION
SPAR - NOTE: TOP OF AFT
WING, FULL SPAN, IS W.L. 55.
TRANSFER LINE FWD. SIDE OF BKHD.
FOR LATER REFERENCE
WL 55-
WL 55 –
B.L.
0
℄
THIS LINE REPRESENTS
OUTLINE OF LIGHTENING
HOLE CUT INTO BKHD.
SEE PHOTO 287
WL 50 –
WL 45 –
BOTTOM OF MAIN CARRY
THRU SPAR
SECT.
A - A
LOWER ENGINE
MOUNT LOCATION
SEE ABOVE NOTE!
WL 41.5
B.L.
-14.7
A
1 PLY BID
@ 45°
1 PLY BID
@ 45°
1/4" BIRCH PLYWOOD
WL 40 –
A
BL 0

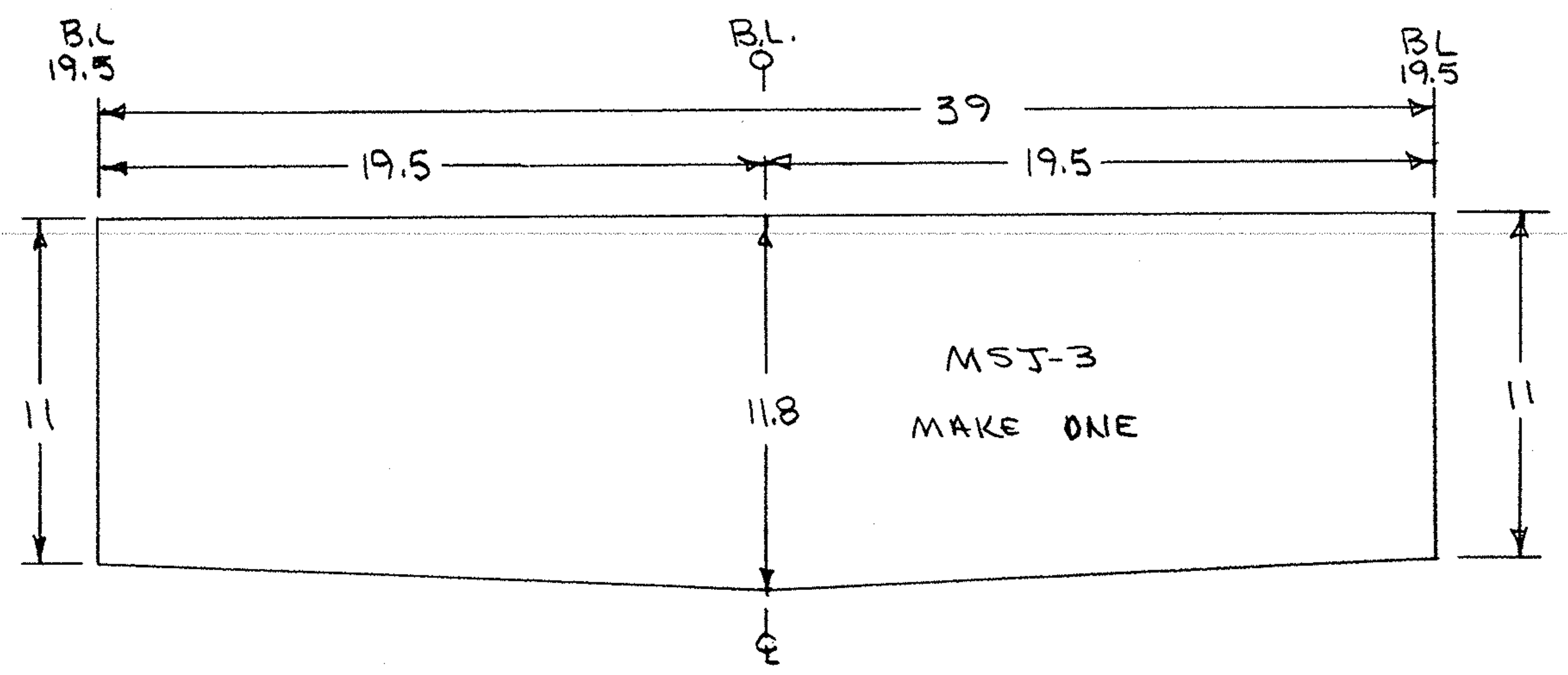


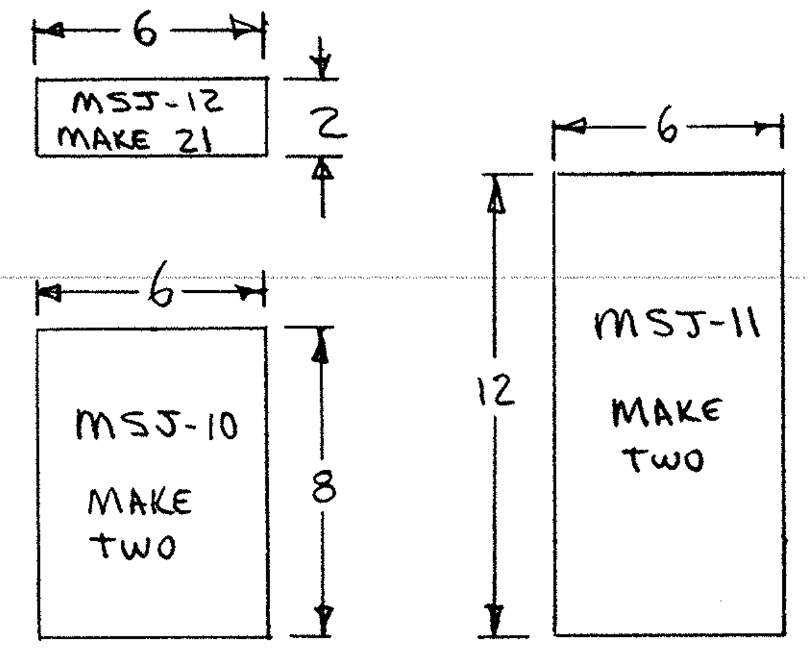


NOTE: MSJ-8 IS BENT IN MIDDLE TO FORM SHAPE OF MSJ-3

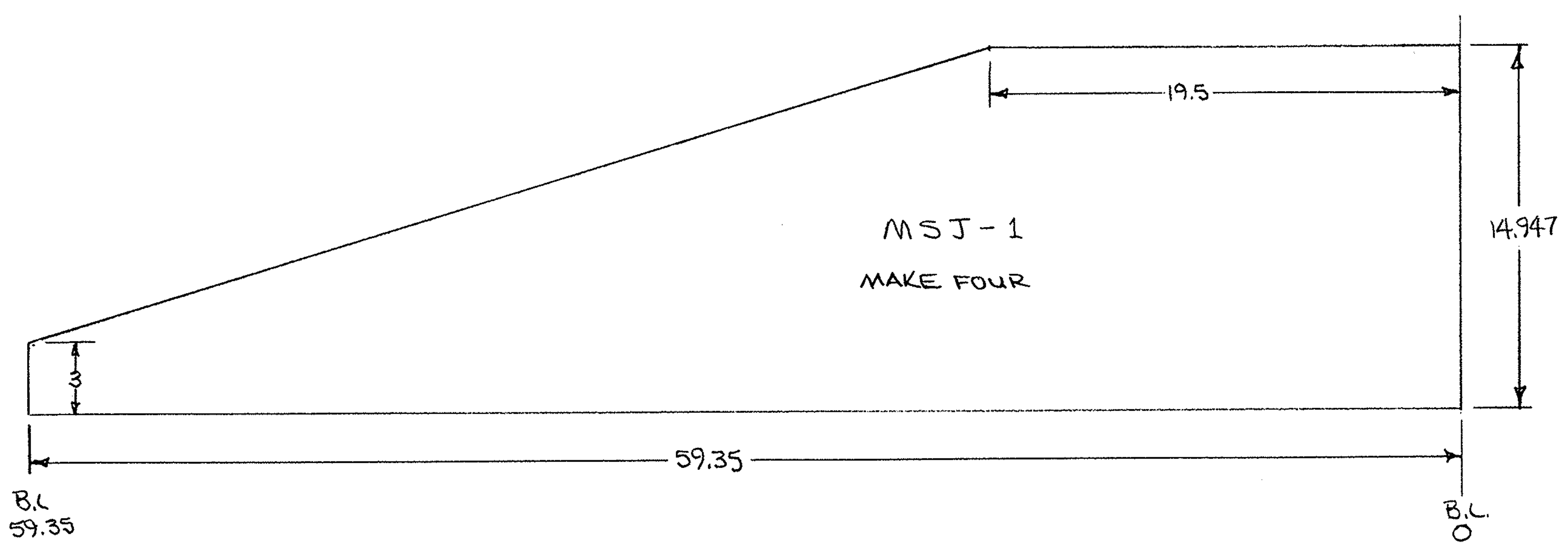


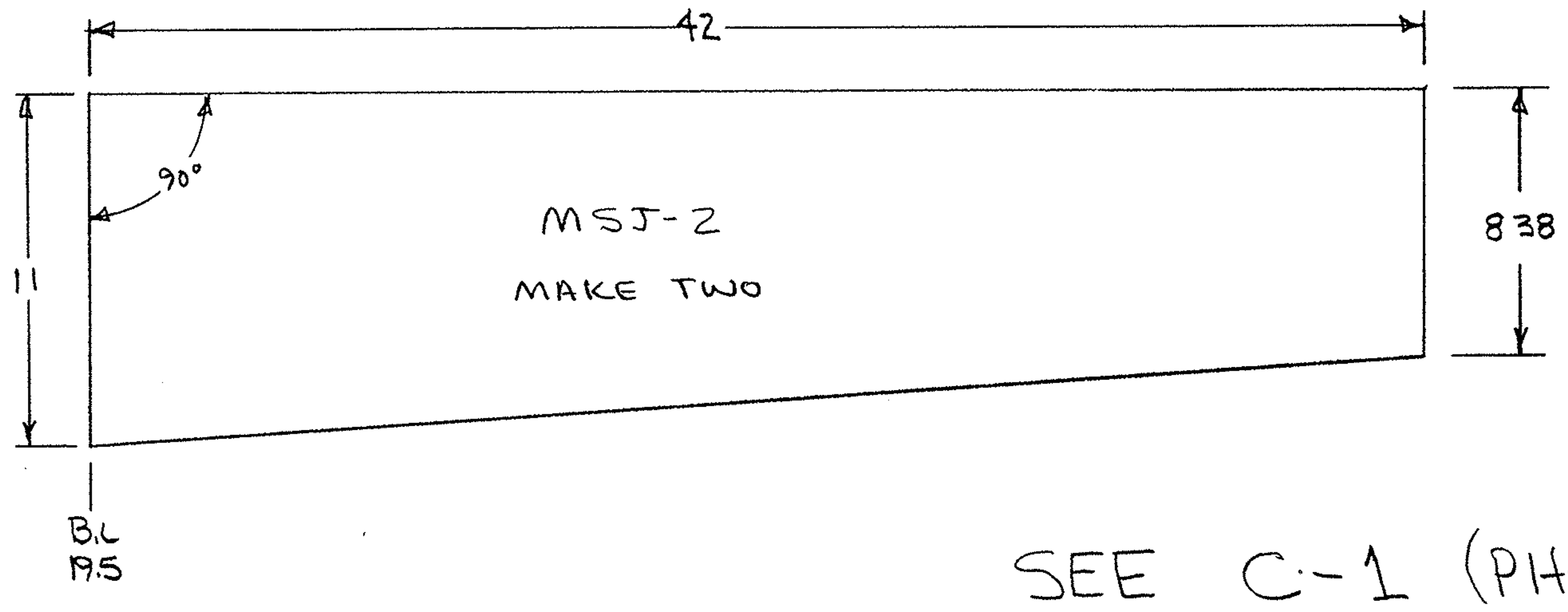
USE ½" WOOD PARTICAL BOARD FOR JIG MATERIAL

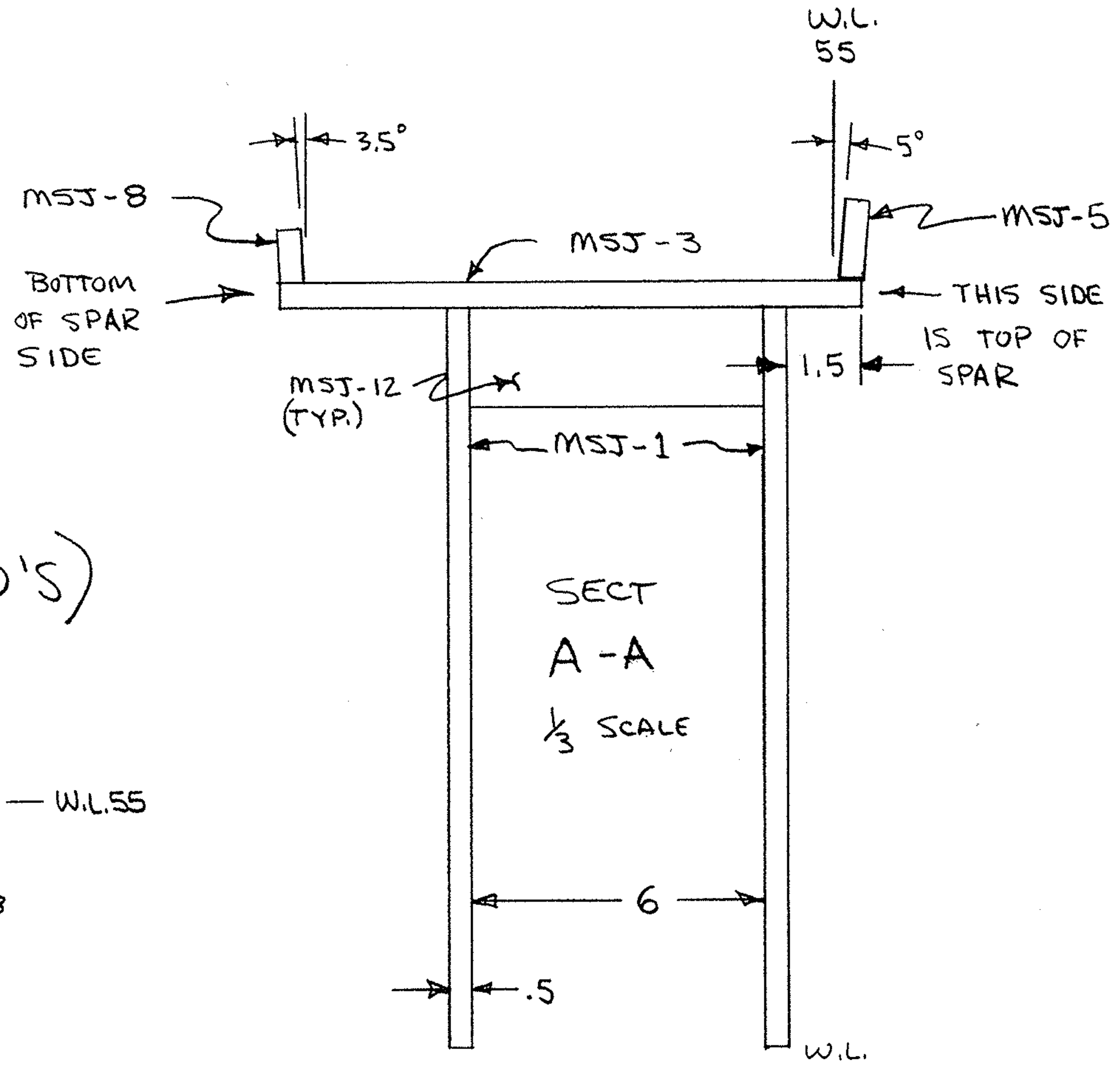




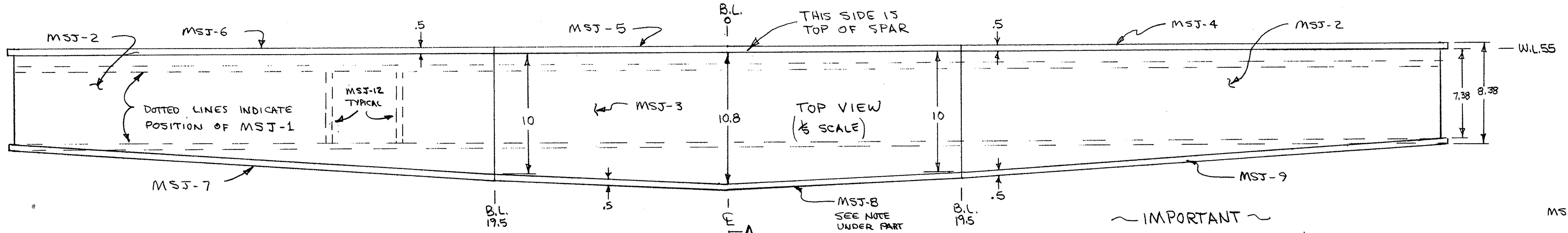
MAIN CARRY THRU SPAR JIG. ALL PARTS MADE FROM ½ PARTICAL BOARD. SECURE JIG TO TABLE FIRMLY WITH WHITE GLUE OR HOT MELT GLUE. ASSEMBLE JIG WITH EITHER GLUE (ELMER'S OR THERMOGRIP)





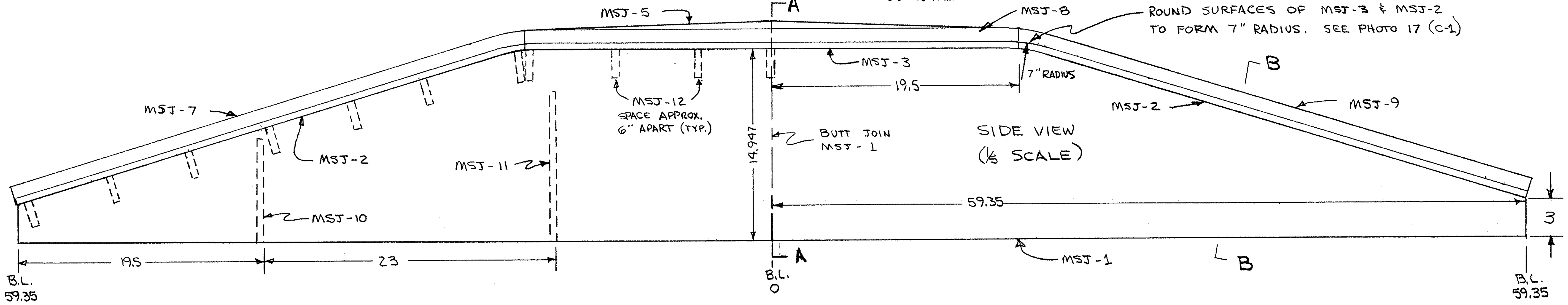


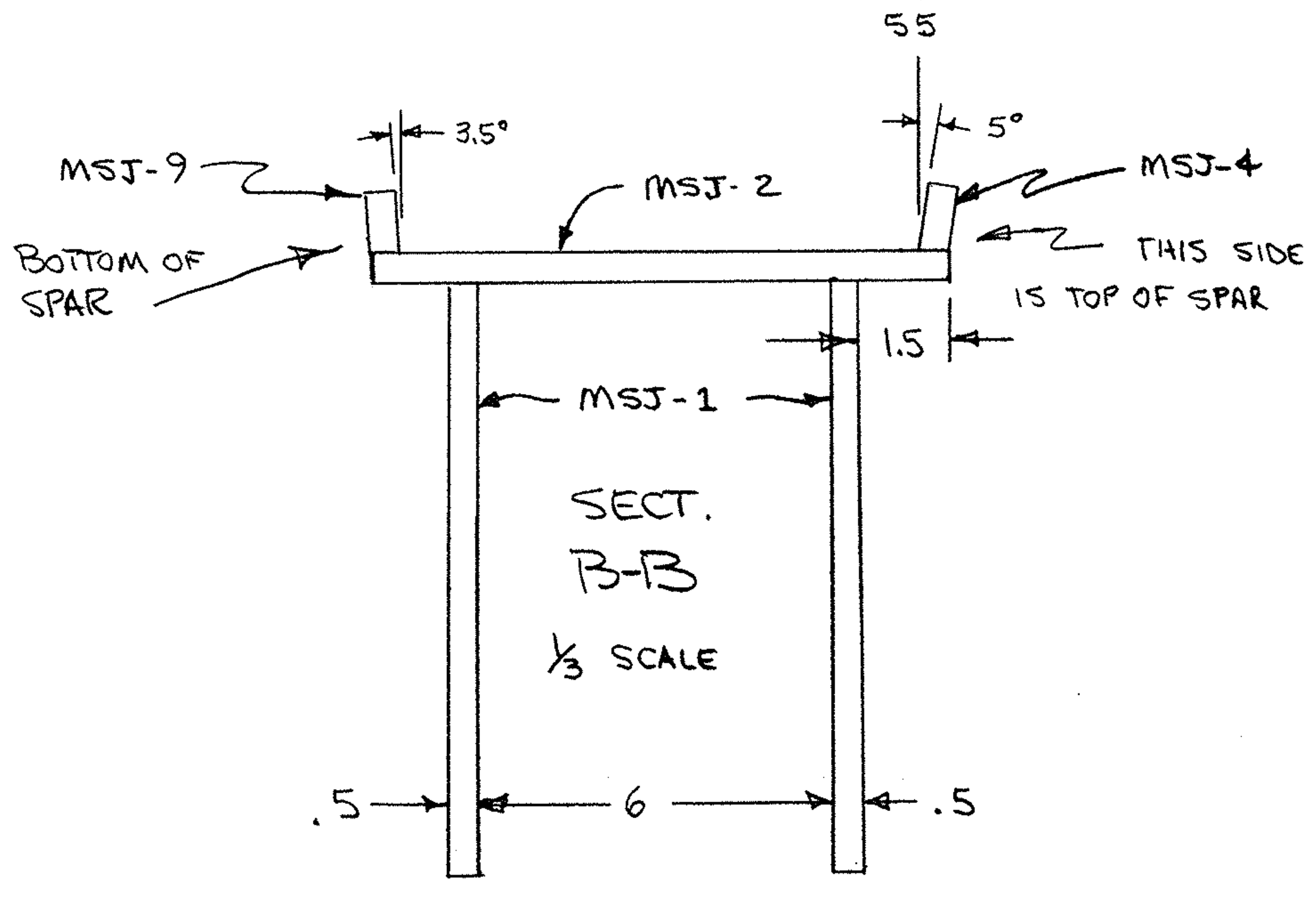
SEE C-1 (PHOTO'S)



~IMPORTANT~

ROUND SURFACES OF MSJ-3 & MSJ-2 TO FORM 7" RADIUS. SEE PHOTO 17 (C-1)





SEE PAGE C-1

NOTE - B
IT IS MOST IMPORTANT THAT THE CORNER OF DWA-5 BE PLACED EXACTLY ON BL 59.35 — INBD. DWA-4 & DWA-8 ARE POSITIONED FROM DWA-5 AS SHOWN

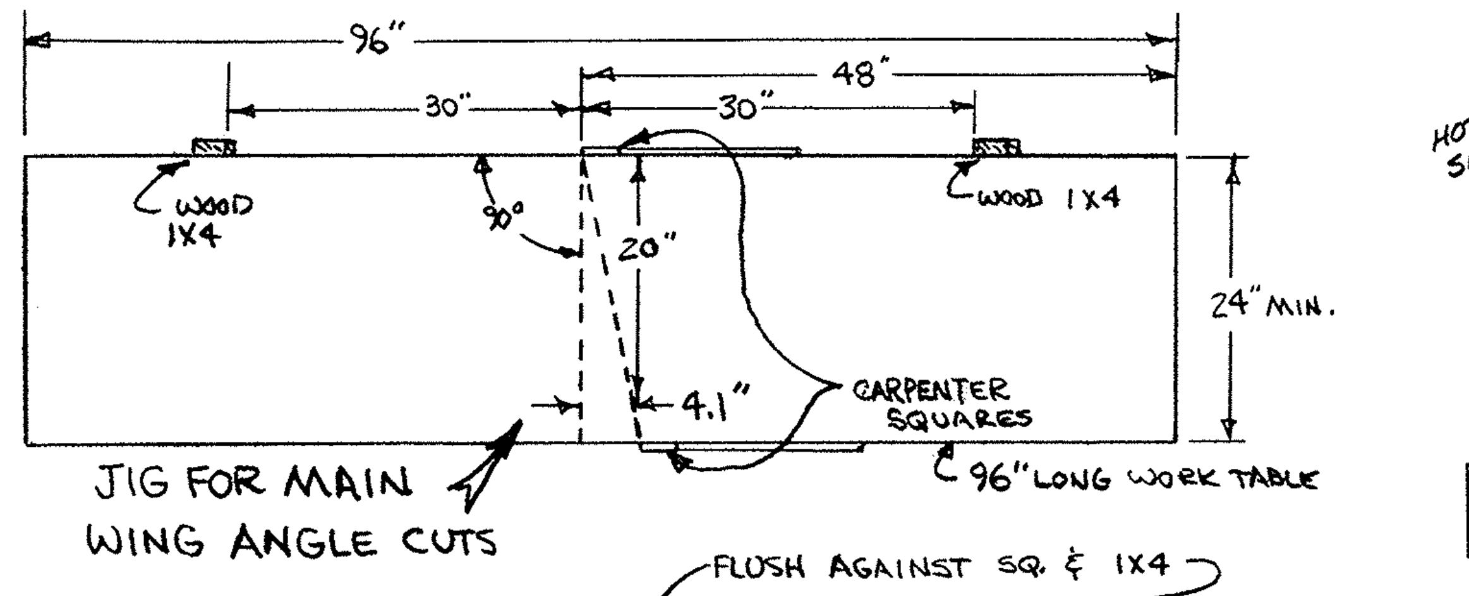
NOTE - A (INBD. ATCH. POINT)
MARK THIS LINE ON BOTH DWA-4 & DWA-8 FOR ALIGNMENT INTO JIG

② SOLID S GLASS
① 6 PLIES UND ± 45° (FULL LENGTH OF SPAR)
1" THICK R45 FOAM
③ 4 PLIES UND ± 45° (FULL LENGTH OF SPAR)
A
TOP OF SPAR IS WL 55
B
② SOLID S GLASS
C
D
.6
WL 55
DWA-5 WITH WA-5 GLASS INSERT
UND ORIENT, ALTERNATE
R45
UND ORIENT, ALTERNATE PLIES
1" R45
1.5
DWA-4
WA-1
UP
RIGHT
~ R45 FOAM ~
FWD. FACE MAIN CARRY THRU SPAR 1/5 SCALE
WA-1
DWA-8
~ 1" R45 FOAM ~
DWA-5 W/ WA-5 GLASS INSERT
.4
1
② SOLID 'S' GLASS
B.L. 59.35
B.L. 19.5
B.L. 0 ℄
B.L. 19.5
B.L. 59.35
1.65
OUTBOARD ATTACH POINT
DWA-5 SEE NOTE-B
DWA-5
3.3
38
37
- SEE NOTE-A (INBD. ATTACH POINT)
DWA-4
AFT SIDE OF SPAR IS F.S. 180
DWA-8
RIGHT
FWD.
TOP VIEW MAIN CARRY THRU SPAR 1/5 SCALE
B.L. 19.5
B.L. 0
B.L. 19.5
3.3
WA - 1
21 ± PLIES BID TO MAKE 1/4" SOLID GLASS PAD APART OF DWA-1 DWA-4 DWA-6 DWA-8 (MAKE FOUR)
BID ORIENT
SOLID GLASS WA1
.250
LEFT
FWD.
SOLID GLASS
WA-1
DWA-8
8 PLIES OF 1/8" BIRCH AIRCRAFT PLYWOOD
FWD.
RIGHT
.5
SOLID GLASS
.250
DWA-4
WA-1
WA-5
21 ± PLIES BID @ 45° TO MAKE 1/4" SOLID GLASS PAD
FULL SCALE
APART OF DWA-5 (MAKE TWO)
BID ORIENT.
SOLID GLASS WA5
5
3.3
.250
1.6
5°
② SOLID 'S' GLASS
MICRO JOINT
1" CORE
R-45 FOAM
ADD'L R45 SAND TO SHAPE ONTO 1" THK CORE BTWN. DWA-4 & DWA7
SECT. A-A BL-0 FULL SCALE
10.8
UP
FWD
① 6 PLIES UND ± 45° AFT FACE
③ 4 PLIES UND ± 45° FWD FACE
② SOLID S GLASS
3.5°
1.1
SOLID S GLASS
WA1 SOLID GLASS
SECT. B-B FULL SCALE
DWA-8
③ 4 PLIES UND ± 45°
① 6 PLIES UND ± 45° AFT FACE
SOLID ② S GLASS
10
3.5°
2.65
90°
BID ORIENT.
~ WA-1 ~
WET FLOX WA-1 INTO DWA-8 (TYPICAL)
~ DWA-8 ~
AFT FACE - LEFT SIDE (FULL SCALE)
(MAKE ONE)
7.1
7
3.3
90°
~ WA-1 ~
~ DWA-4 ~
AFT FACE - RIGHT SIDE (FULL SCALE)
(MAKE ONE)
8 PLIES 1/8" PLYWOOD
7.5
FWD FACE
TOP VIEW (DWA-5)
4 PLIES 1/4" BIRCH ACFT. PLYWOOD
DWA-5 MAKE TWO
AFT FACE SHOWN (FULL SCALE)
MARK ℄ ON PART FOR ALIGN'T INTO JIG
WA-5
WET FLOX WA-5 INTO DWA-5 (TYP.)
6.4
.8
5
.6
SOLID GLASS
FWD FACE DWA-5
WL 55
SOLID ② S GLASS
① 6 PLIES UND ± 45° AFT FACE
③ 4 PLIES UND ± 45° FWD. FACE
SECT. C-C FULL SCALE
R45 FOAM
②SOLID S GLASS
WL 55
SOLID ② S GLASS
DWA-5
UP
FWD
7.38
WA5 SOLID GLASS
① 6 PLIES UND ± 45° AFT FACE
③ 4 PLIES UND ± 45°
S ② GLASS
SECT. D-D BL. 59.35 FULL SCALE

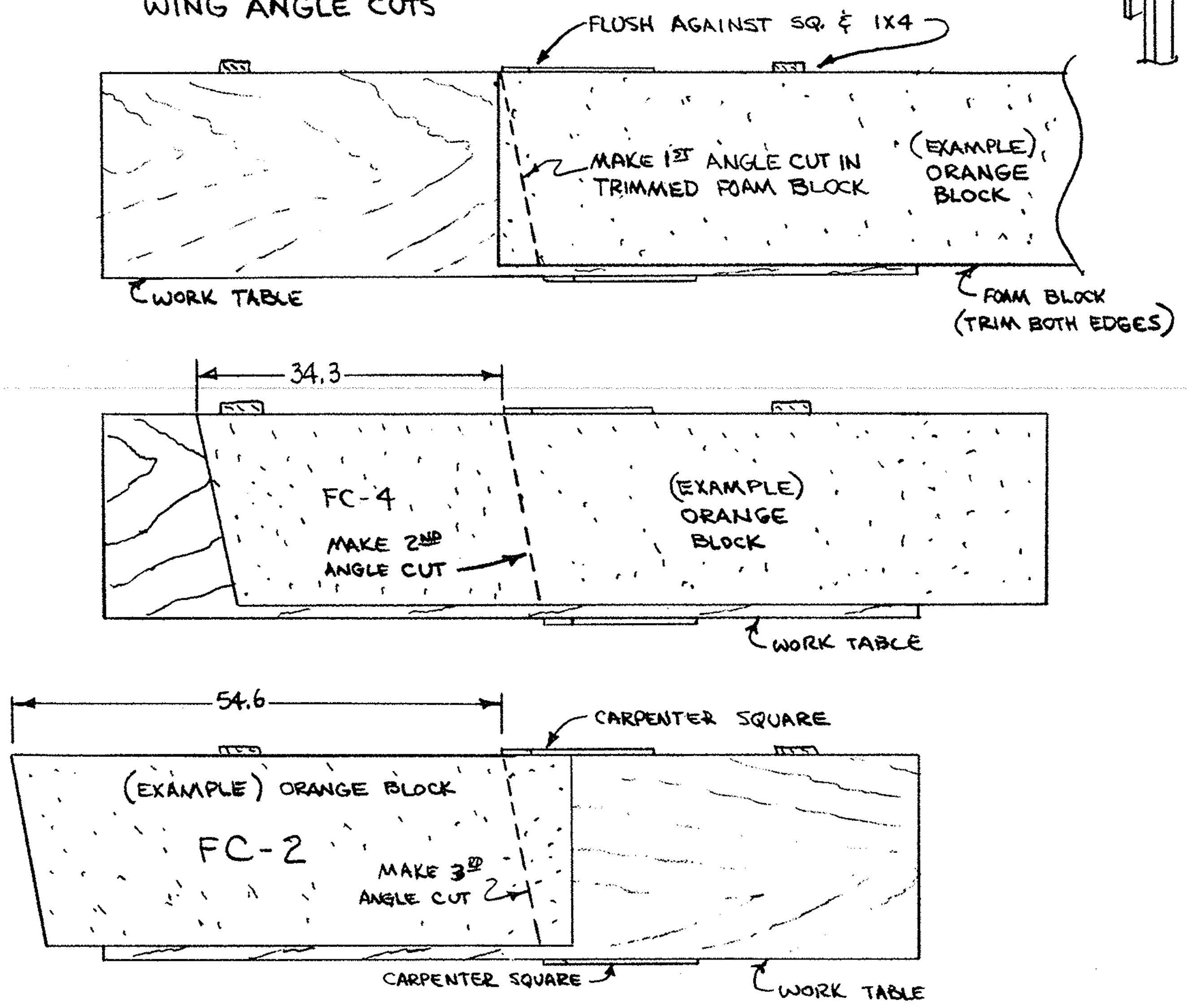
(SLURRY ALL FOAM)

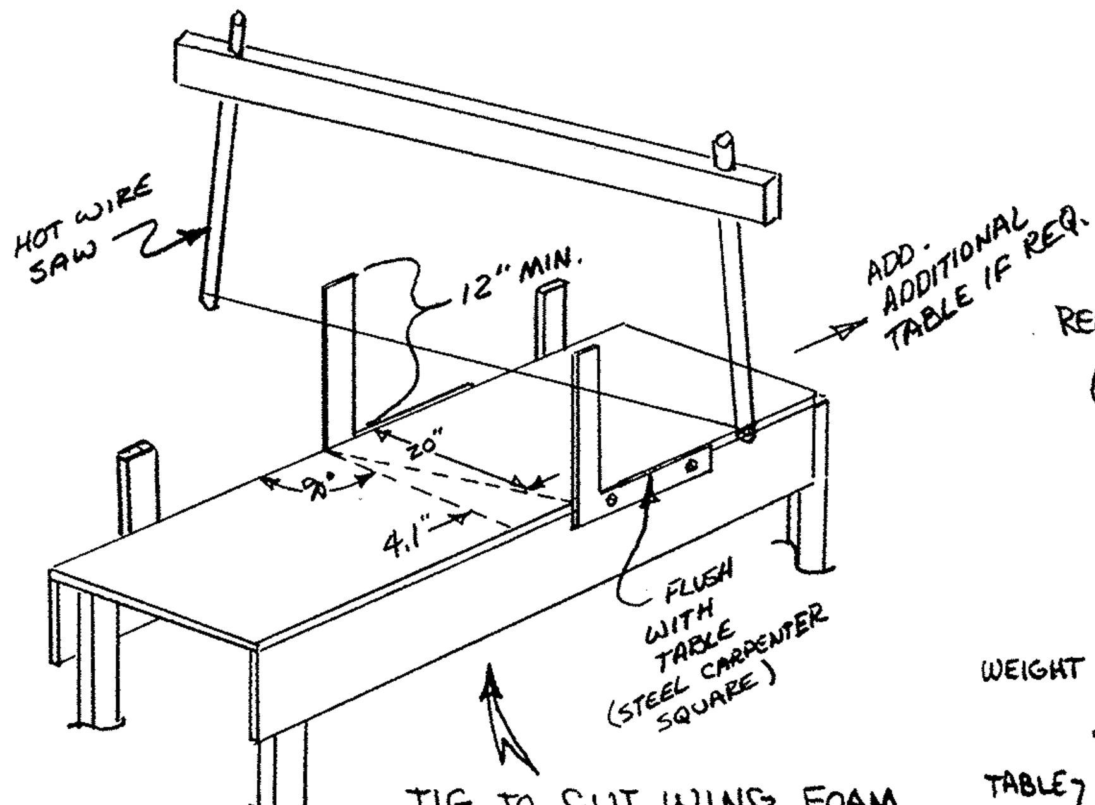
SEE D-30 FOR ADDED INFORMATION TO "HARDPOINT" LOCATIONS.

(SEE C-1)

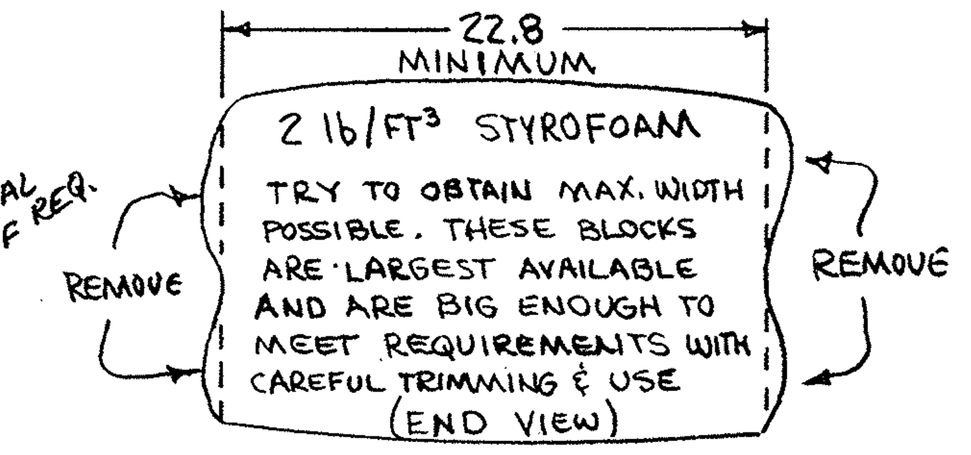


JIG FOR MAIN WING ANGLE CUTS




HOT WIRE SAW
12" MIN.
4.1"
ADD ADDITIONAL TABLE IF REQ.
FLUSH WITH TABLE (STEEL CARPENTER SQUARE)

JIG TO CUT WING FOAM BLOCK ANGLES - BE EXACT ON THE 20" & 4.1" MEASUREMENTS TO ESTABLISH THE 11.59° ANGLE REQUIRED. THE 11.59° IS SWEEP OF TRAILING EDGE OF MAIN WINGS

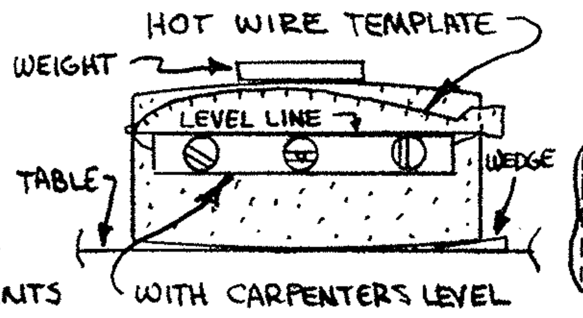


2 lb/FT³ STYROFOAM

TRY TO OBTAIN MAX. WIDTH POSSIBLE. THESE BLOCKS ARE LARGEST AVAILABLE AND ARE BIG ENOUGH TO MEET REQUIREMENTS WITH CAREFUL TRIMMING & USE

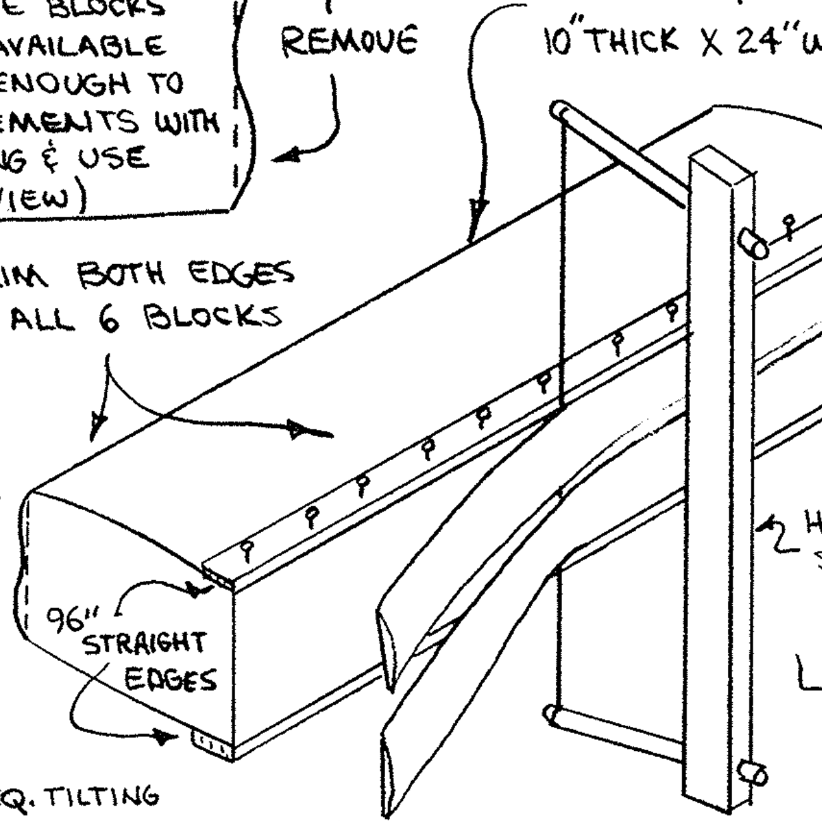
(END VIEW)

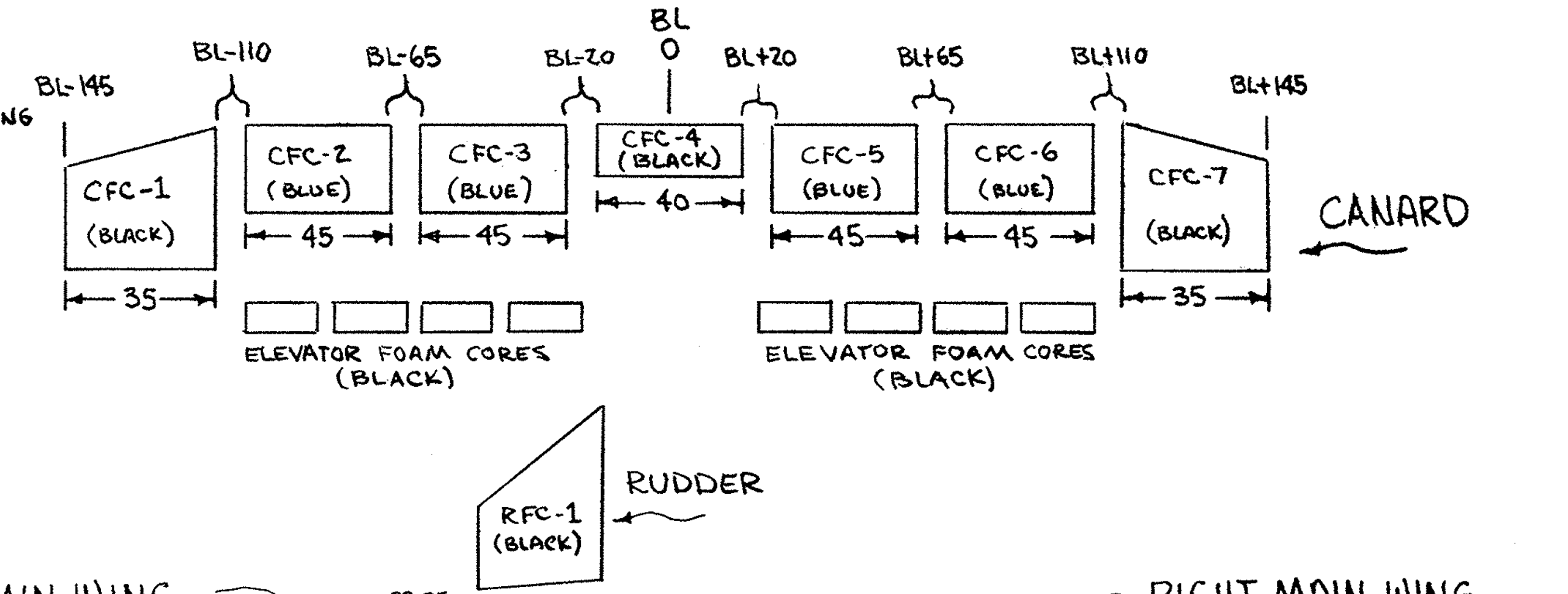
TRIM BOTH EDGES OF ALL 6 BLOCKS

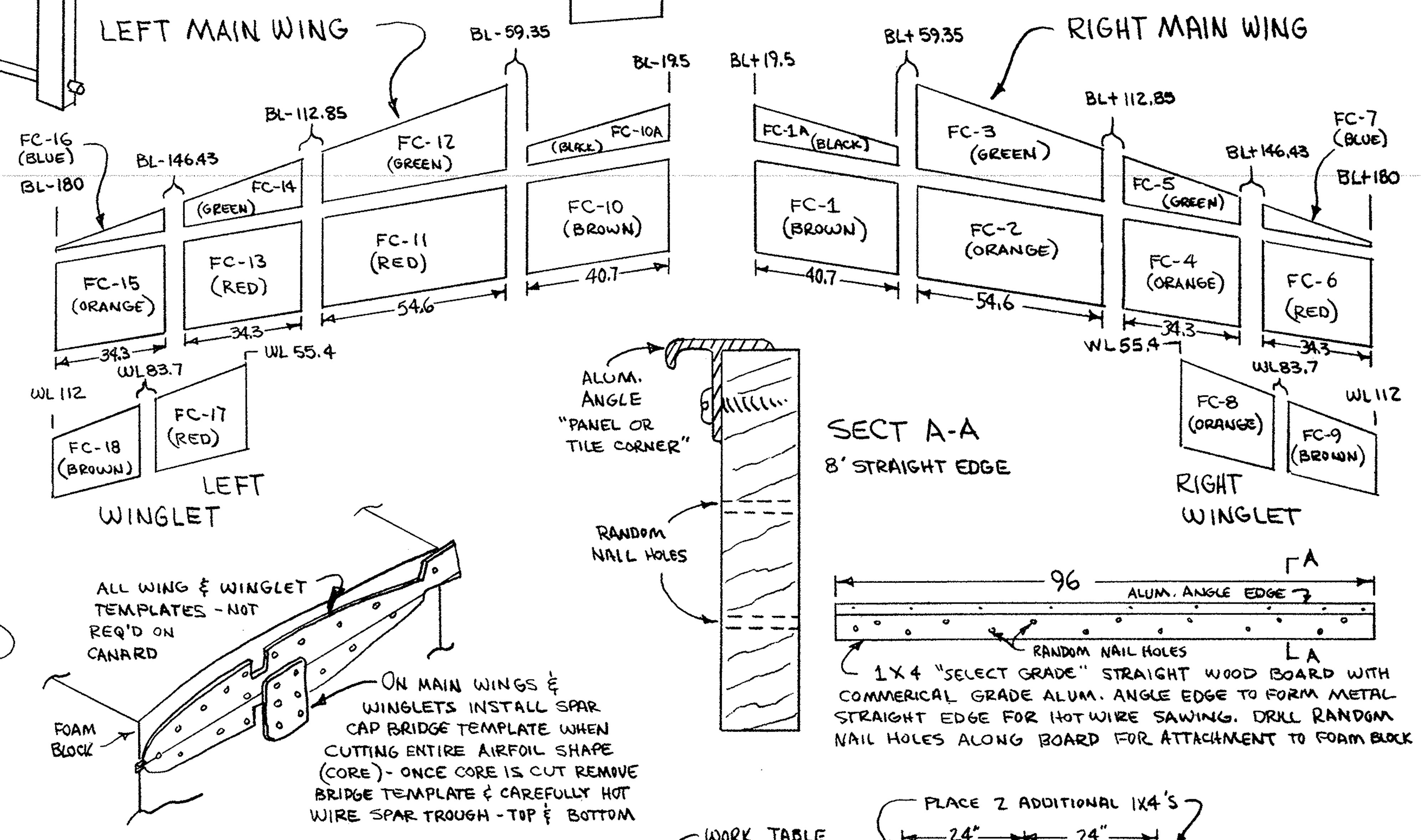


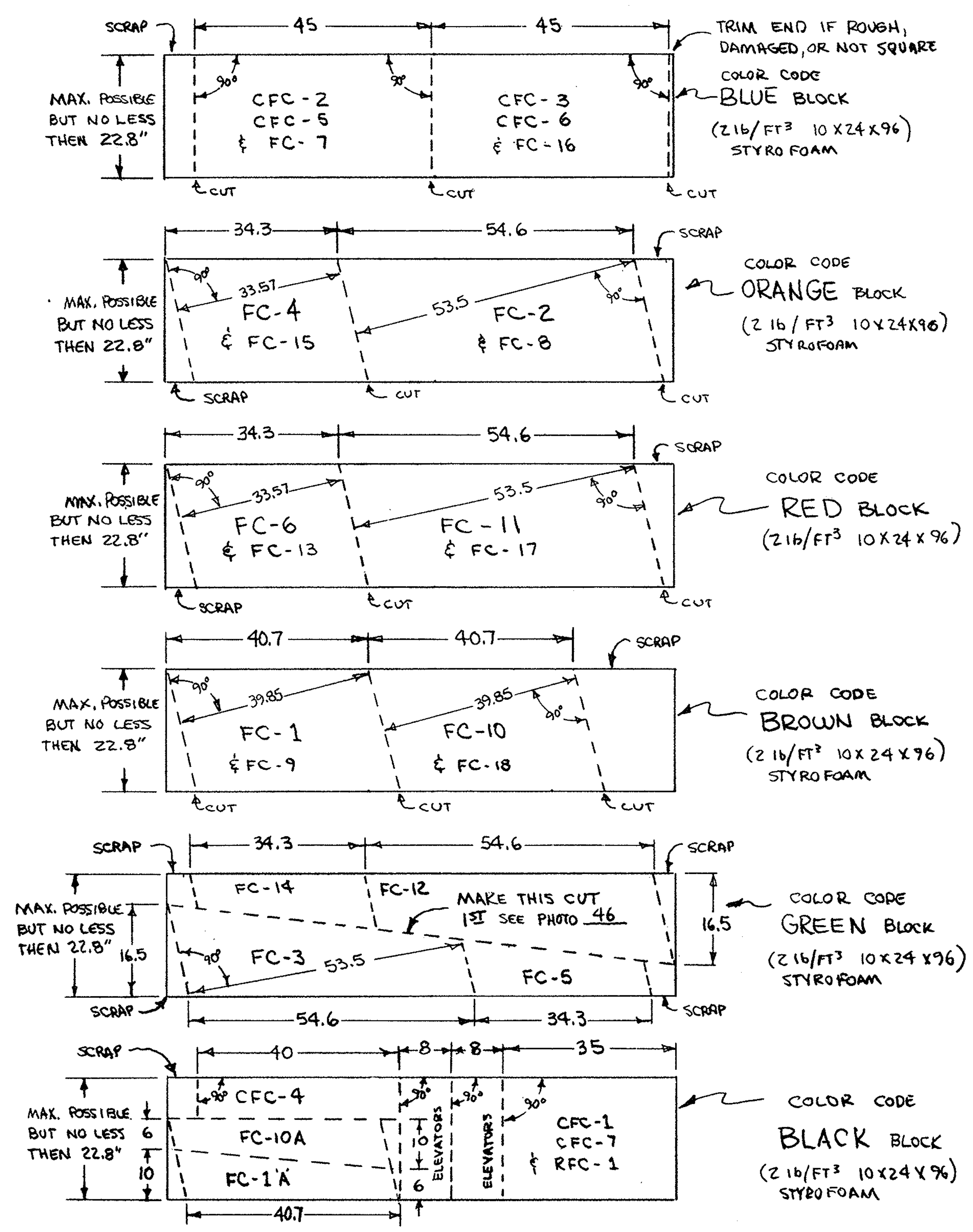
WITH CARPENTERS LEVEL CAREFULLY ALIGN EACH CORRESPONDING TEMPLATE LEVEL WITH EACH OTHER.

NOTE: FOAM BLOCK MAY REQ. TILTING TO OBTAIN NEEDED SPACE FOR TEMPLATES TO BE LEVELED WITH EACH OTHER.









COLOR CODE **BLUE** BLOCK (2 lb/FT³ 10X24X96) STYROFOAM

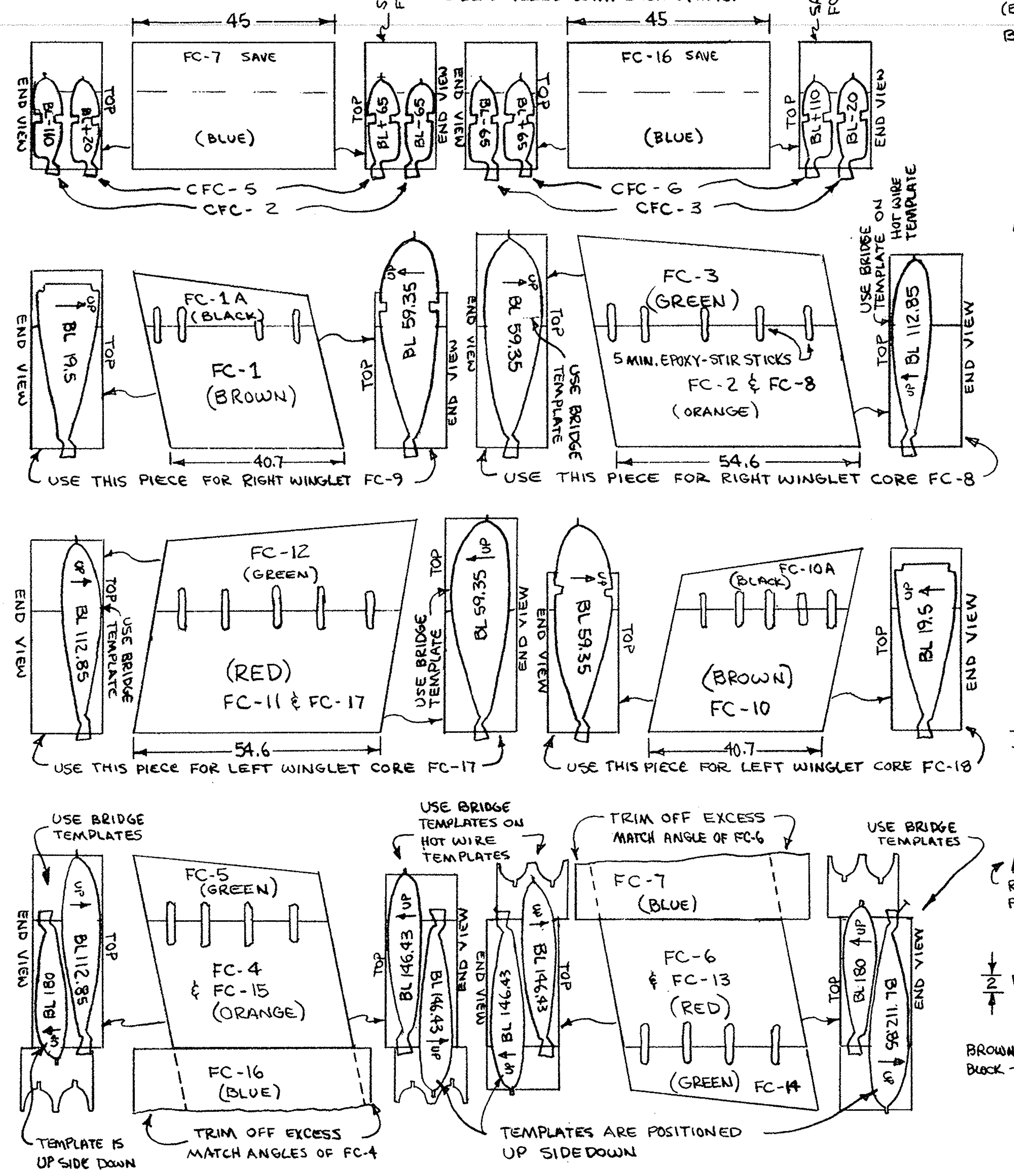
COLOR CODE **ORANGE** BLOCK (2 lb/FT³ 10X24X96) STYROFOAM

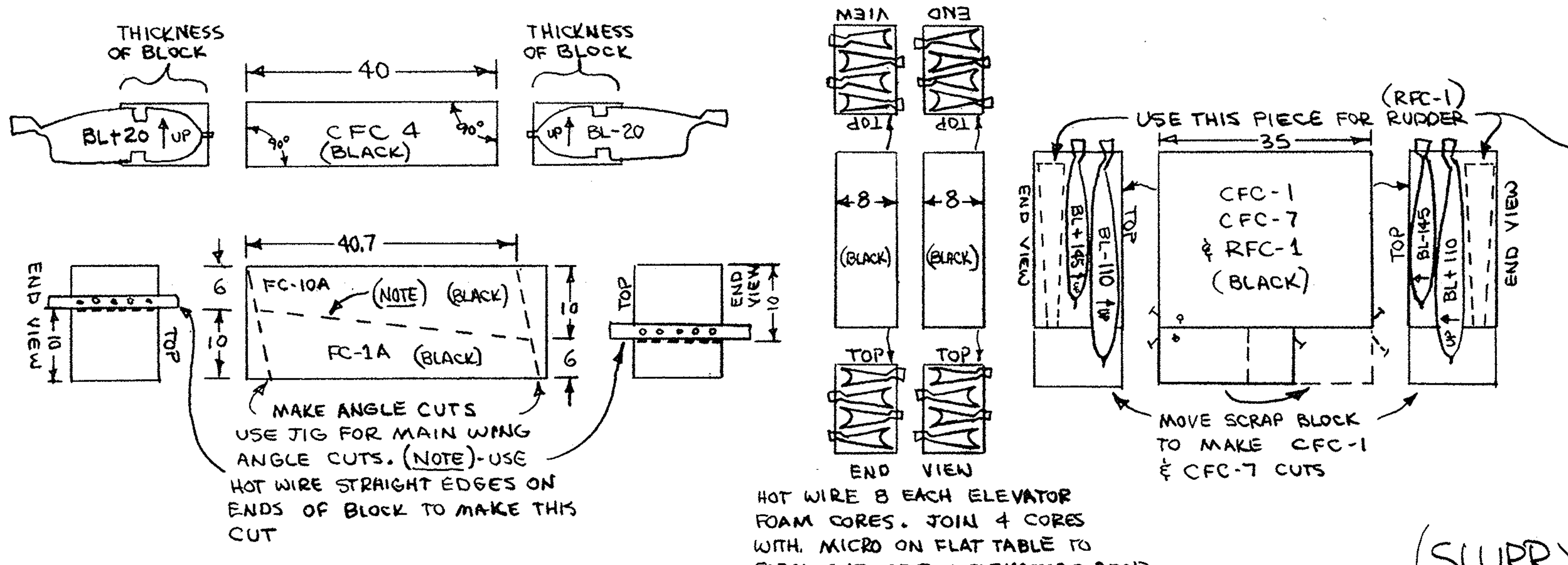
COLOR CODE **RED** BLOCK (2 lb/FT³ 10X24X96)

COLOR CODE **BROWN** BLOCK (2 lb/FT³ 10X24X96) STYROFOAM

COLOR CODE **GREEN** BLOCK (2 lb/FT³ 10X24X96) STYROFOAM

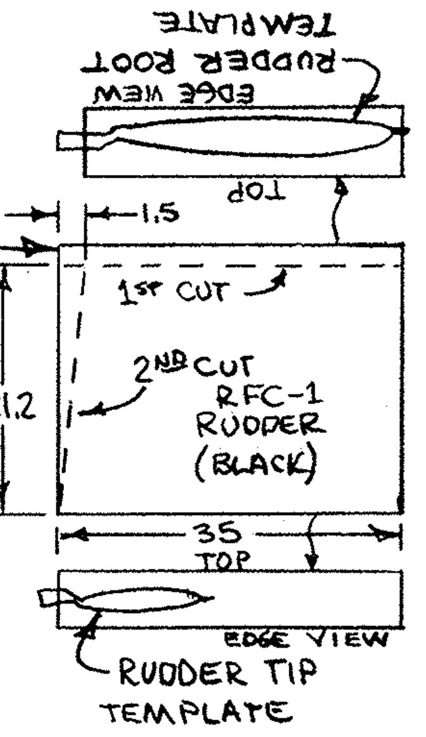
COLOR CODE **BLACK** BLOCK (2 lb/FT³ 10X24X96) STYROFOAM





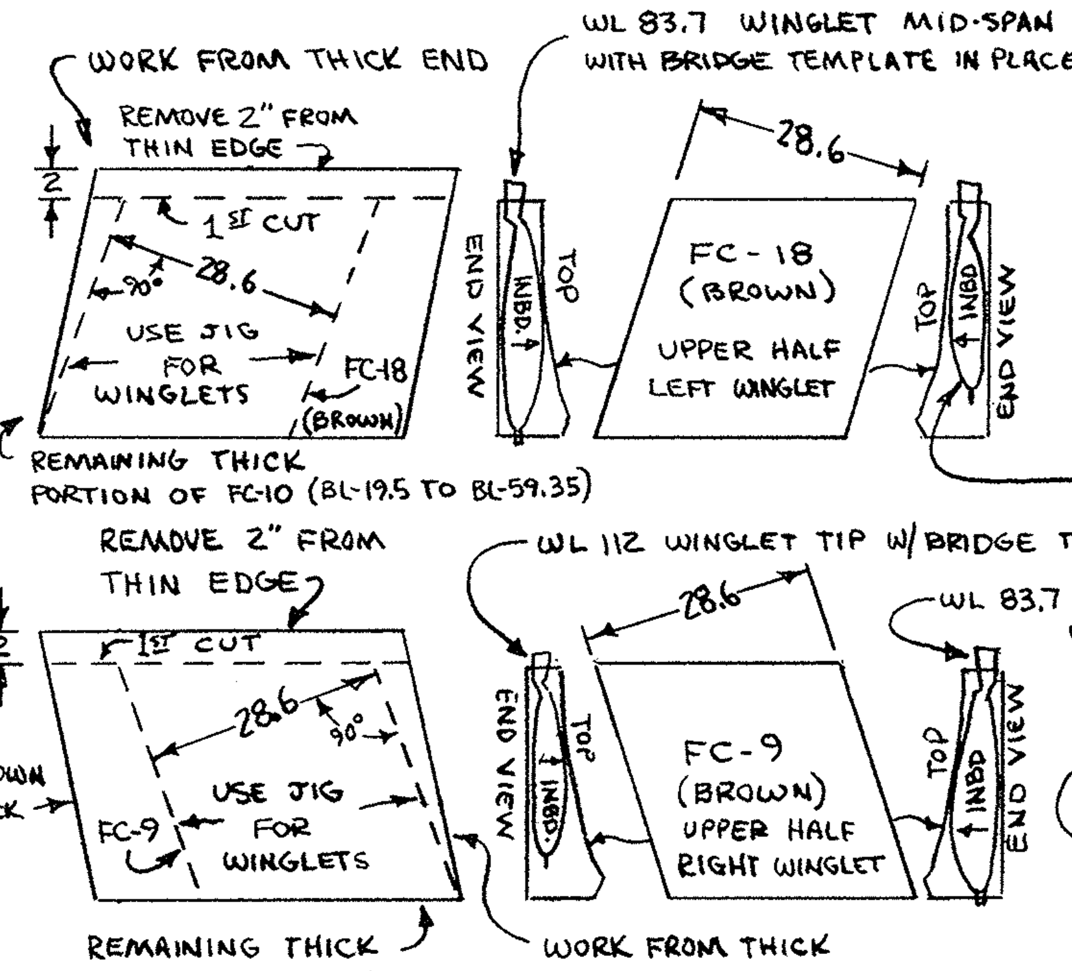
MAKE ANGLE CUTS USE JIG FOR MAIN WING ANGLE CUTS. (NOTE)-USE HOT WIRE STRAIGHT EDGES ON ENDS OF BLOCK TO MAKE THIS CUT

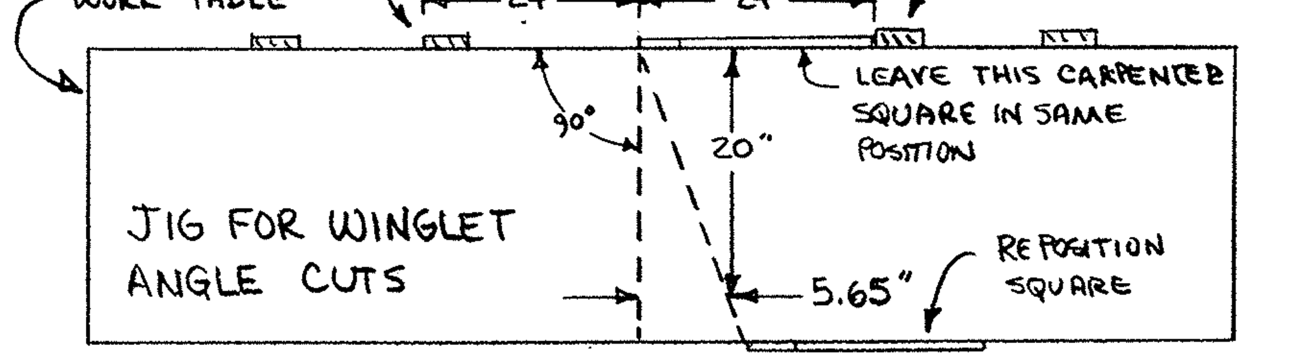
HOT WIRE 8 EACH ELEVATOR FOAM CORES. JOIN 4 CORES WITH MICRO ON FLAT TABLE TO FORM ONE OF TWO ELEVATORS REQ'D. "HOT WIRING SHORT CORES MAKES A MORE TRUE CUT - LESS WIRE LAG"



ON MAIN WINGS & WINGLETS INSTALL SPAR CAP BRIDGE TEMPLATE WHEN CUTTING ENTIRE AIRFOIL SHAPE (CORE) - ONCE CORE IS CUT REMOVE BRIDGE TEMPLATE & CAREFULLY HOT WIRE SPAR TROUGH - TOP & BOTTOM

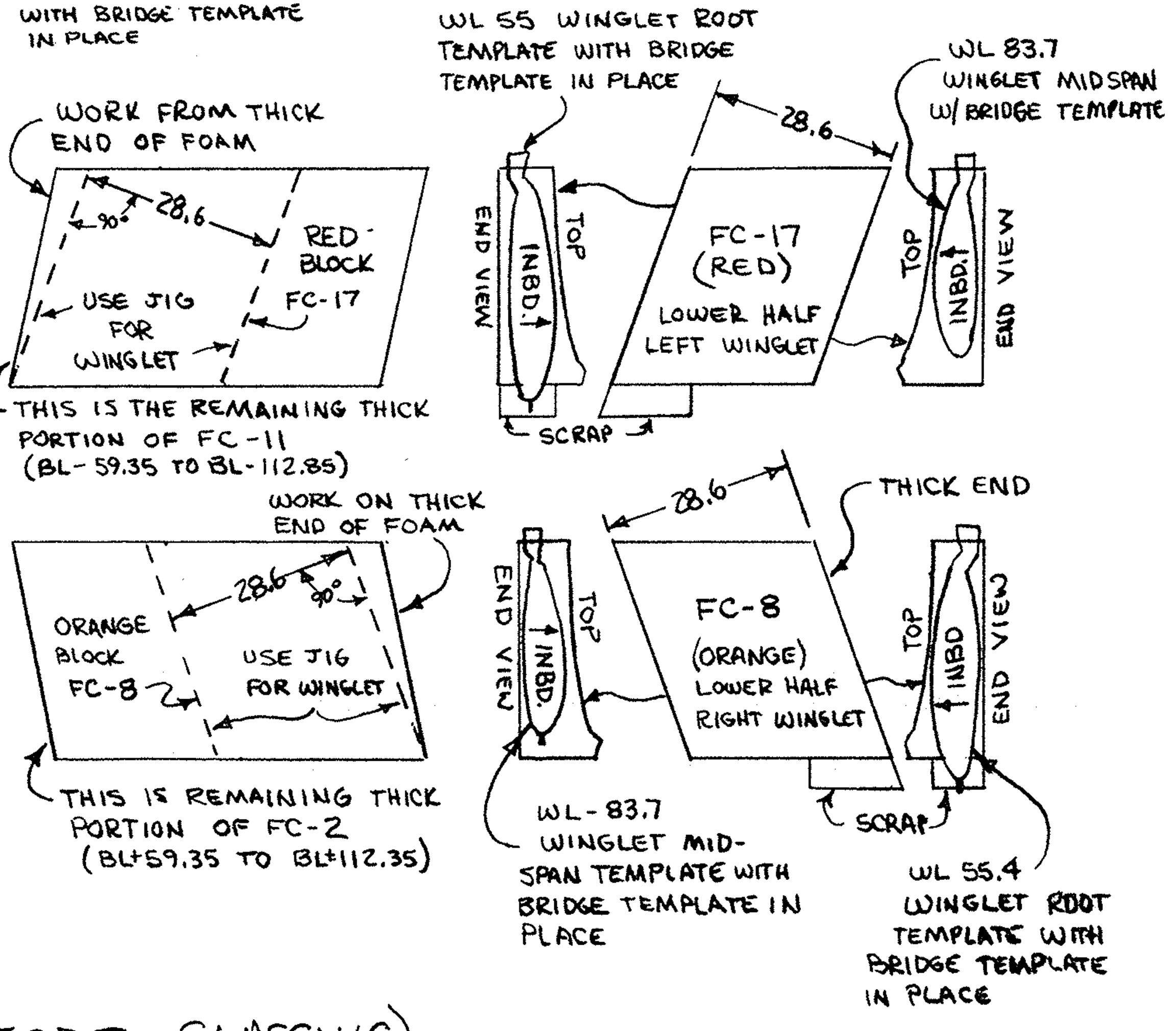
1X4 "SELECT GRADE" STRAIGHT WOOD BOARD WITH COMMERICAL GRADE ALUM. ANGLE EDGE TO FORM METAL STRAIGHT EDGE FOR HOT WIRE SAWING. DRILL RANDOM NAIL HOLES ALONG BOARD FOR ATTACHMENT TO FOAM BLOCK


WORK FROM THICK END
REMOVE 2" FROM THIN EDGE
2
1ST CUT
28.6
90°
USE JIG FOR WINGLETS
FC-18 (BROWN)
REMAINING THICK PORTION OF FC-10 (BL-19.5 TO BL-59.35)
WL 83.7 WINGLET MID-SPAN WITH BRIDGE TEMPLATE IN PLACE
END VIEW
TOP
INBD.
28.6
FC-18 (BROWN)
UPPER HALF LEFT WINGLET
REMOVE 2" FROM THIN EDGE
1ST CUT
BROWN BLOCK
FC-9
USE JIG FOR WINGLETS
REMAINING THICK PORTION OF FC-1 (BL+19.5 TO BL+59.35)
WL 112 WINGLET TIP W/ BRIDGE TEMPLATE
WL 83.7 WINGLET MID-SPAN WITH BRIDGE TEMPLATE IN PLACE
FC-9 (BROWN) UPPER HALF RIGHT WINGLET
WORK FROM THICK END OF FOAM

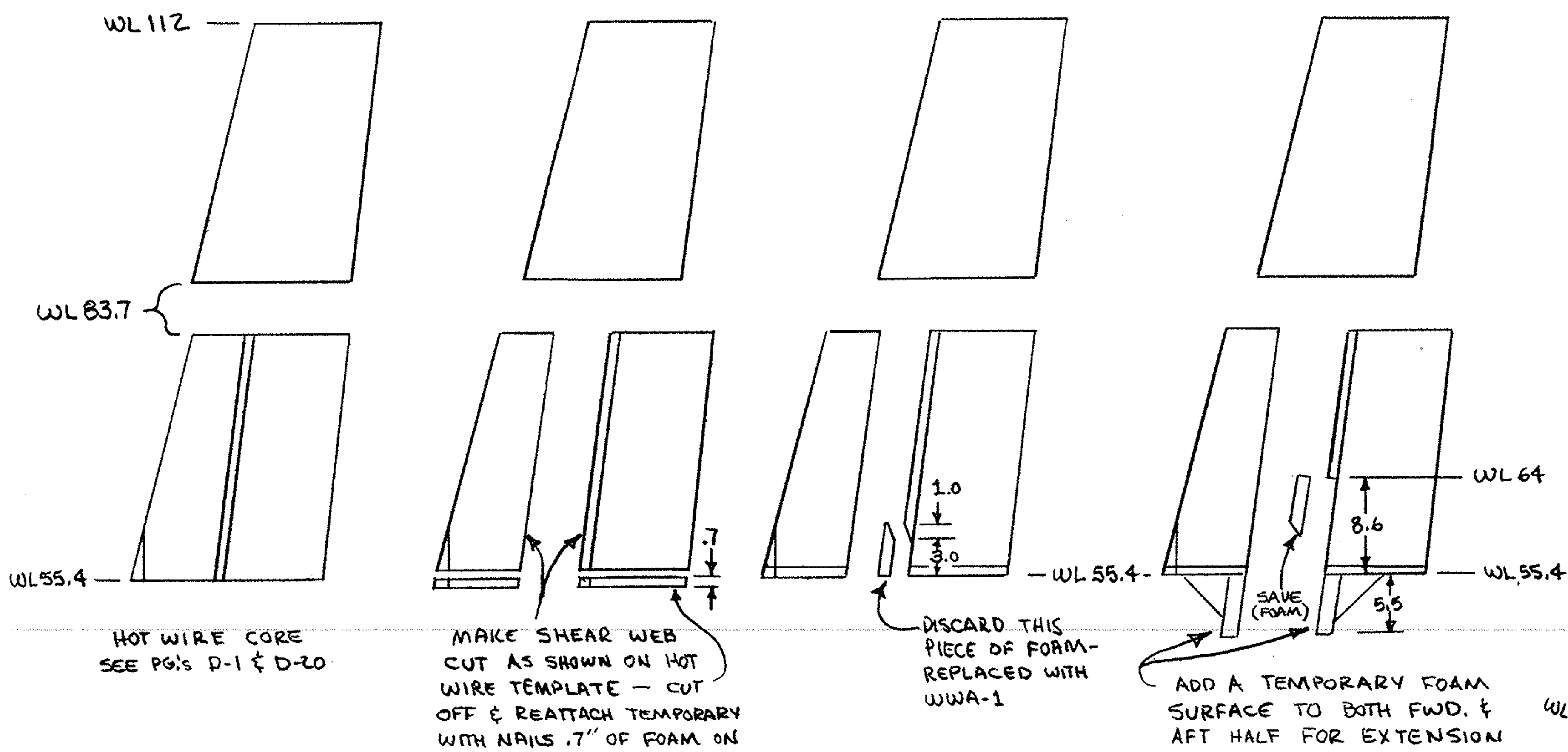


JIG FOR WINGLET ANGLE CUTS

AFTER COMPLETION OF MAIN WINGS FOAM CUTS, REPOSITION CARPENTER SQUARE TO NEW ANGLE. BE EXACT ON THE 20" & 5.65" MEASUREMENTS TO ESTABLISH THE 15.78° ANGLE REQUIRED. THE 15.78° IS THE VERTICAL SWEEP OF THE TRAILING EDGE OF BOTH WINGLETS


WORK FROM THICK END OF FOAM
28.6
90°
RED BLOCK
FC-17
USE JIG FOR WINGLET
THIS IS THE REMAINING THICK PORTION OF FC-11 (BL-59.35 TO BL-112.85)
WL 55 WINGLET ROOT TEMPLATE WITH BRIDGE TEMPLATE IN PLACE
WL 83.7 WINGLET MIDSPAN W/ BRIDGE TEMPLATE
END VIEW
TOP
INBD.
FC-17 (RED) LOWER HALF LEFT WINGLET
SCRAP
WORK ON THICK END OF FOAM
ORANGE BLOCK
FC-8
USE JIG FOR WINGLET
THIS IS REMAINING THICK PORTION OF FC-2 (BL+59.35 TO BL+112.35)
THICK END
FC-8 (ORANGE) LOWER HALF RIGHT WINGLET
SCRAP
WL-83.7 WINGLET MID-SPAN TEMPLATE WITH BRIDGE TEMPLATE IN PLACE
WL 55.4 WINGLET ROOT TEMPLATE WITH BRIDGE TEMPLATE IN PLACE

(SLURRY ALL FOAMS BEFORE GLASSING) (SEE C-2)



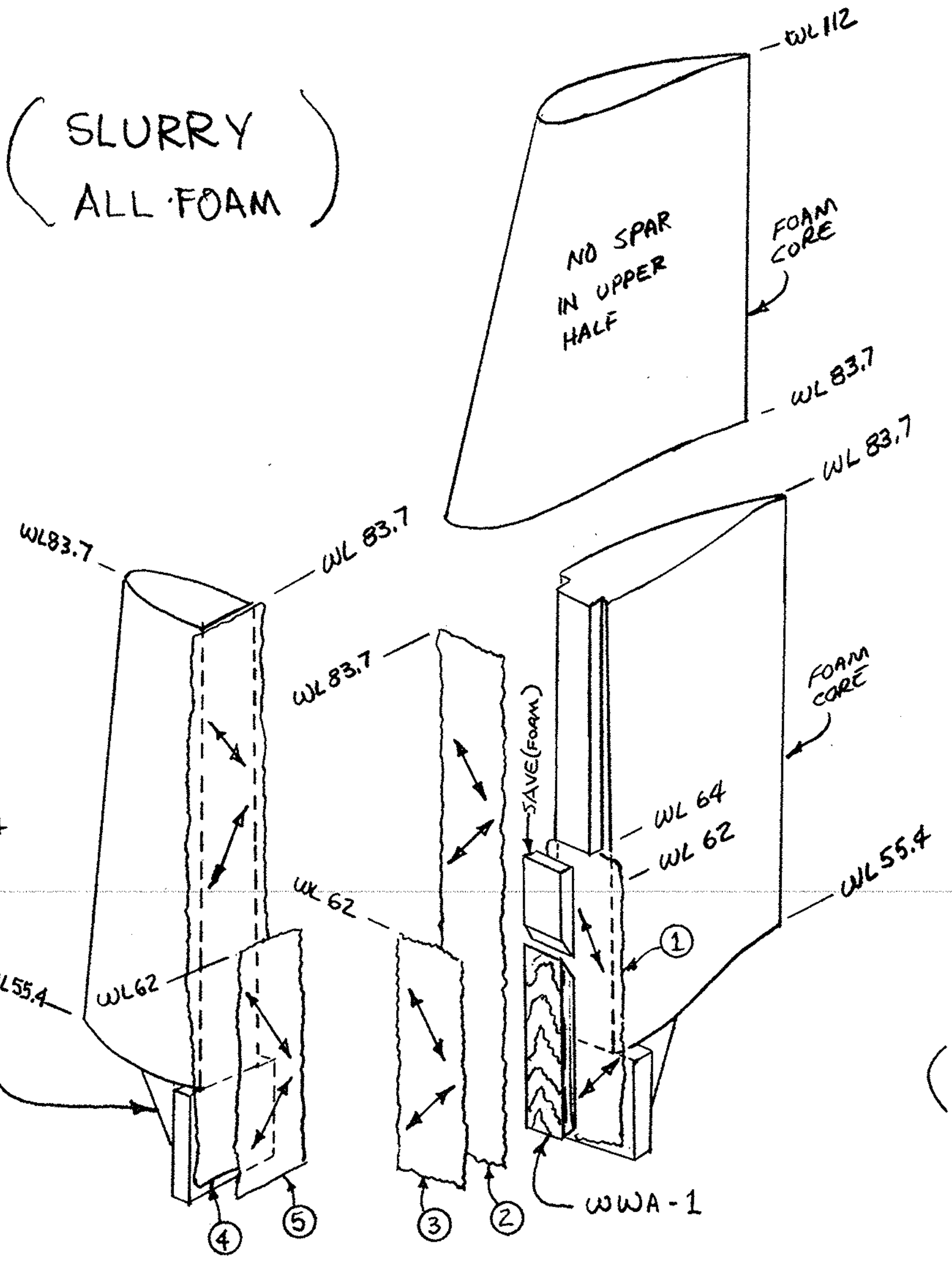
HOT WIRE CORE SEE PG's D-1 & D-20

MAKE SHEAR WEB CUT AS SHOWN ON HOT WIRE TEMPLATE — CUT OFF & REATTACH TEMPORARY WITH NAILS .7" OF FOAM ON ROOT END

DISCARD THIS PIECE OF FOAM- REPLACED WITH WWA-1

ADD A TEMPORARY FOAM SURFACE TO BOTH FWD. & AFT HALF FOR EXTENSION OF SPAR STUB.

(SLURRY ALL FOAM)



SHEAR WEB LAYUPS

① 2 PLIES UND @ ± 45° WL 64 TO END OF STUB

② 2 PLIES UND @ ± 45° WL 83.7 TO END OF STUB

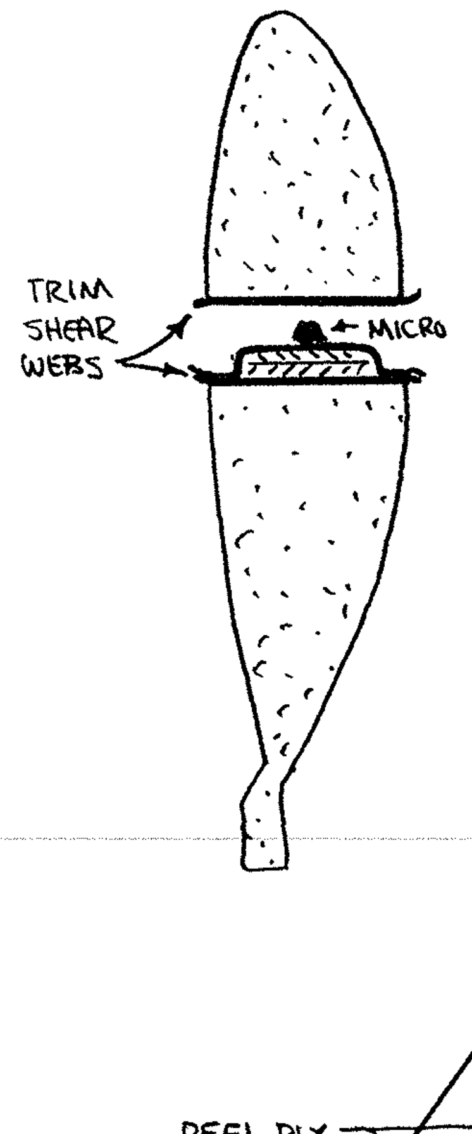
③ 2 PLIES UND @ ± 45° WL 62 TO END OF STUB

④ 2 PLIES UND @ ± 45° WL 83.7 TO END OF STUB

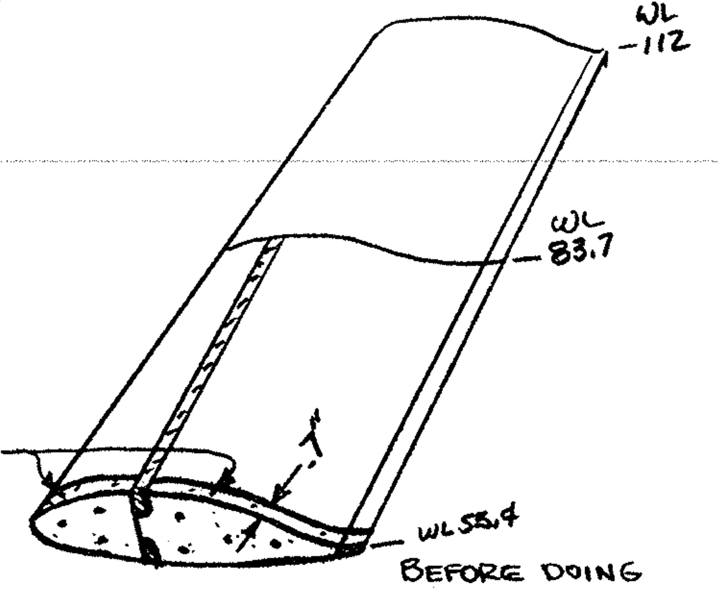
⑤ 2 PLIES UND @ ± 45° WL 62 TO END OF STUB

SHEAR WEBS ON BOTH WINGLET ARE DONE THE SAME USING ABOVE LAYUP SCHEDULE

(PEEL PLY ENTIRE SURFACE OF BOTH SHEAR WEB FACES)

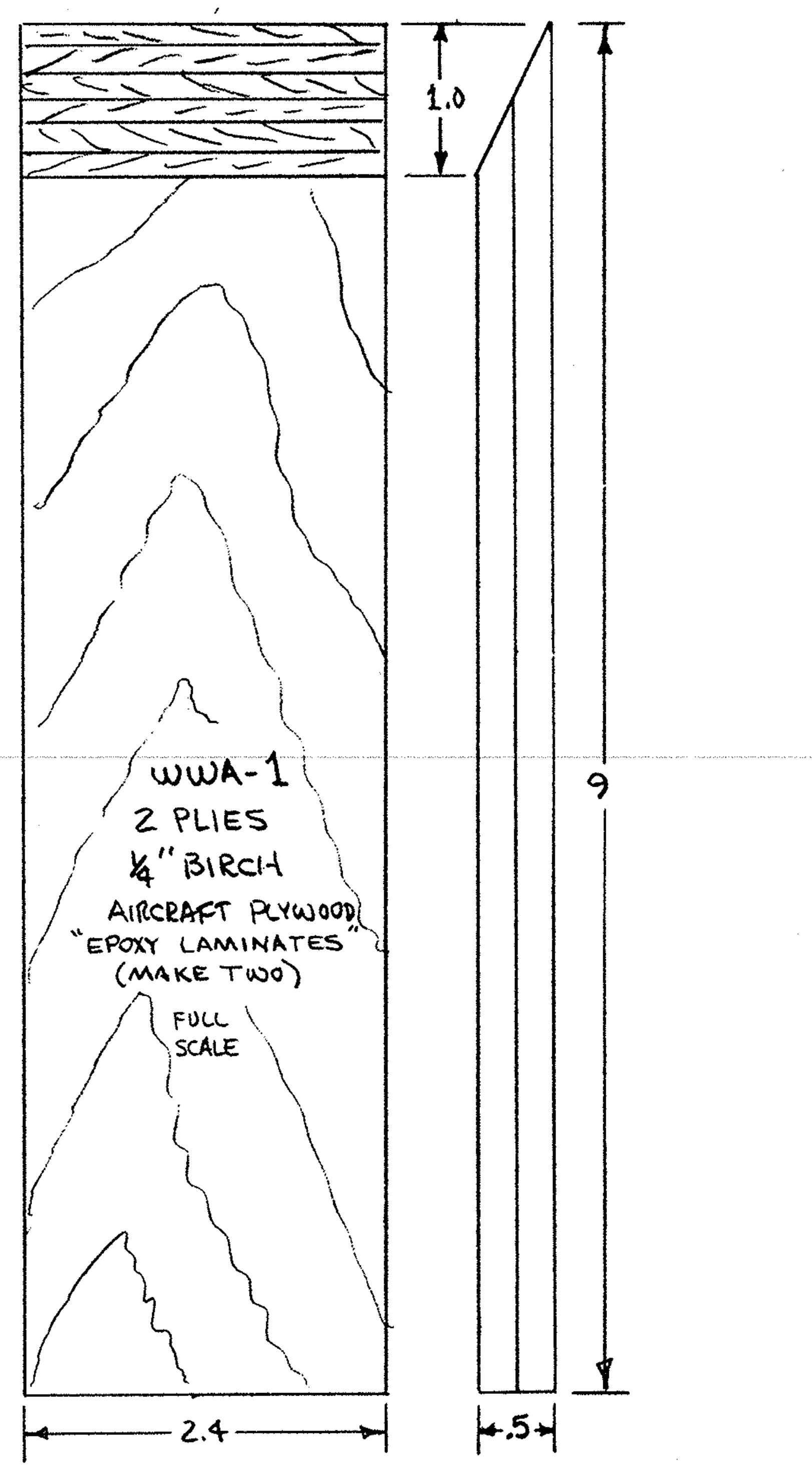


REMOVE PEEL PLY - TRIM EDGES OF SHEAR WEBS FLUSH, TROWEL ON A 1/2" RIDGE OF MICRO ON AFT SURFACE THE FULL LENGTH & REMATE PARTS CHECK LEVEL LINES FOR ALIGNMENT

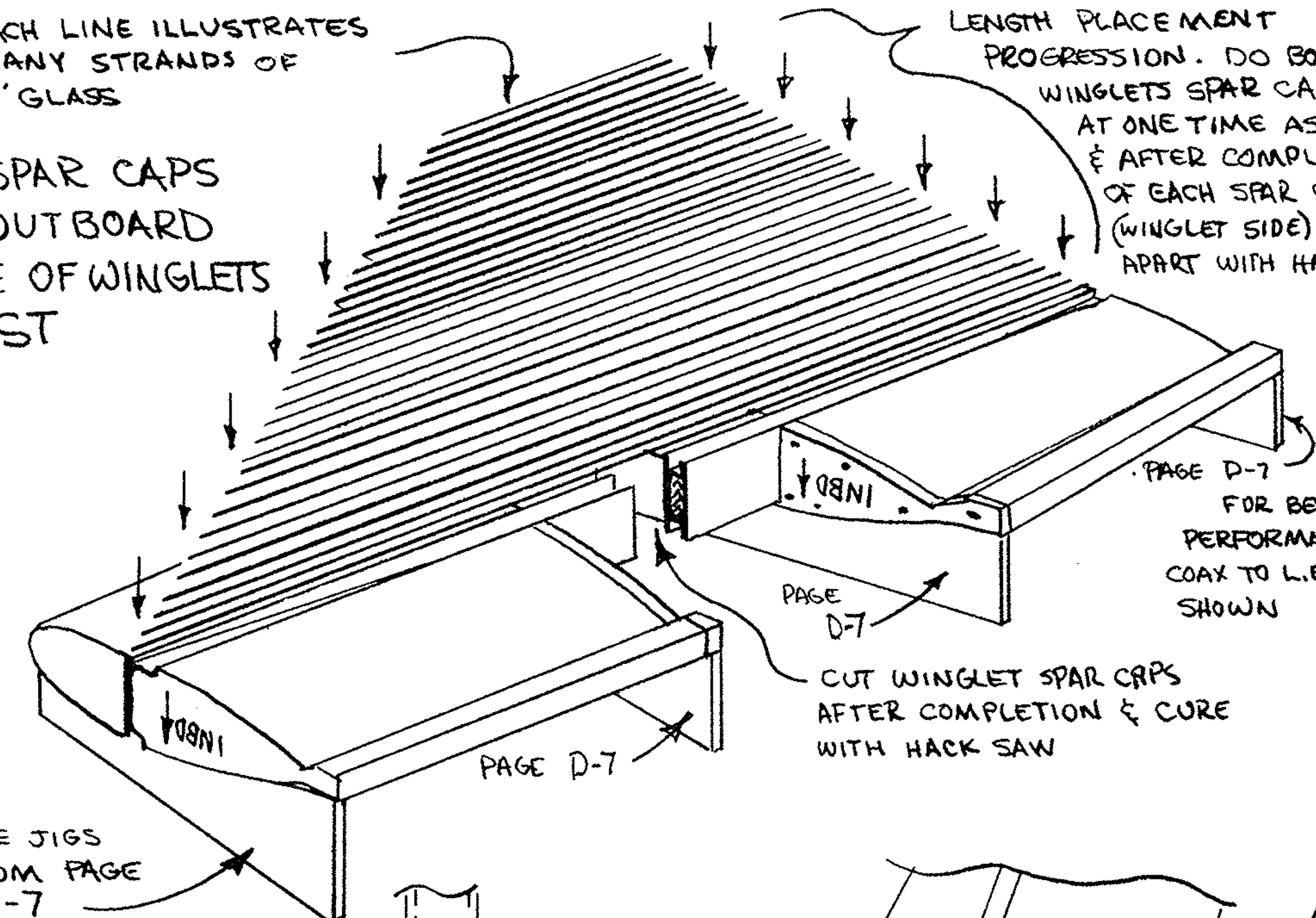


PEEL PLY HOLD IN PLACE WITH SMALL BRAD NAILS

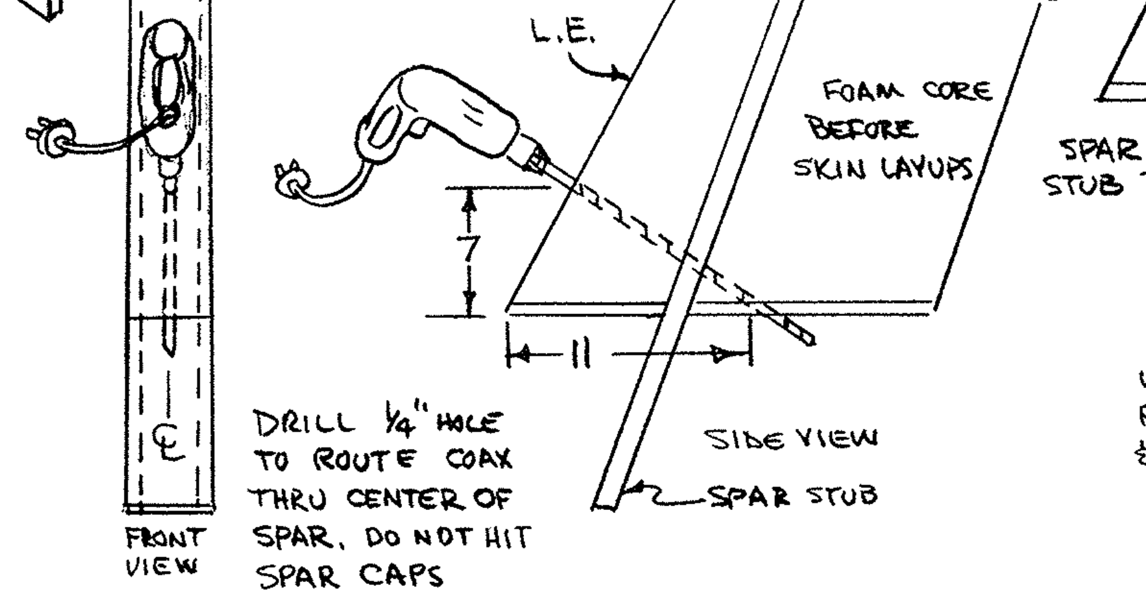
BEFORE DOING SKIN LAYUPS WRAP PEEL PLY ALL AROUND THE EDGE OF .7" FOAM ROOT BEING HELD IN PLACE WITH NAILS. THIS ALLOWS EASY & CLEAN REMOVAL OF FOAM LATER



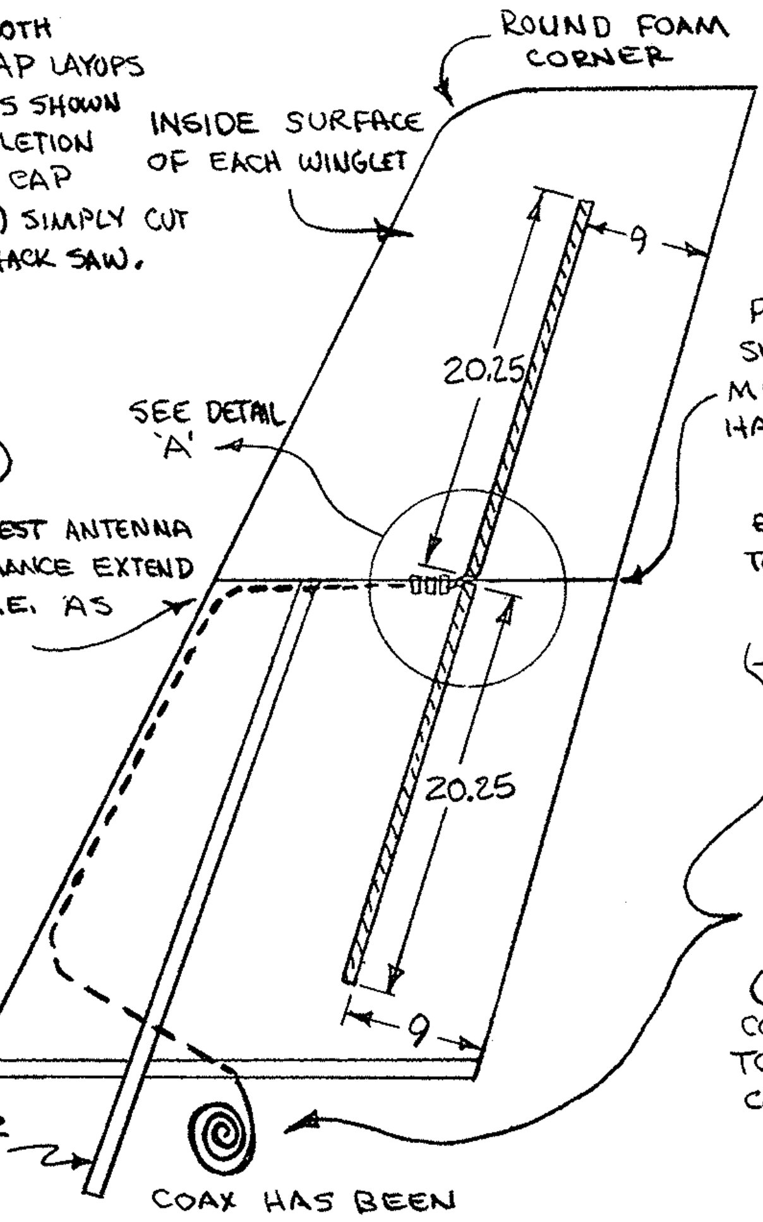
DO SPAR CAPS ON OUTBOARD SIDE OF WINGLETS FIRST


EACH LINE ILLUSTRATES MANY STRANDS OF 'S' GLASS
EXAMPLE OF 'S' GLASS LENGTH PLACEMENT PROGRESSION. DO BOTH WINGLETS SPAR CAP LAYUPS AT ONE TIME AS SHOWN & AFTER COMPLETION OF EACH SPAR CAP (WINGLET SIDE) SIMPLY CUT APART WITH HACK SAW.
INBD
PAGE D-7
PAGE D-7
INBD
PAGE D-7
CUT WINGLET SPAR CAPS AFTER COMPLETION & CURE WITH HACK SAW

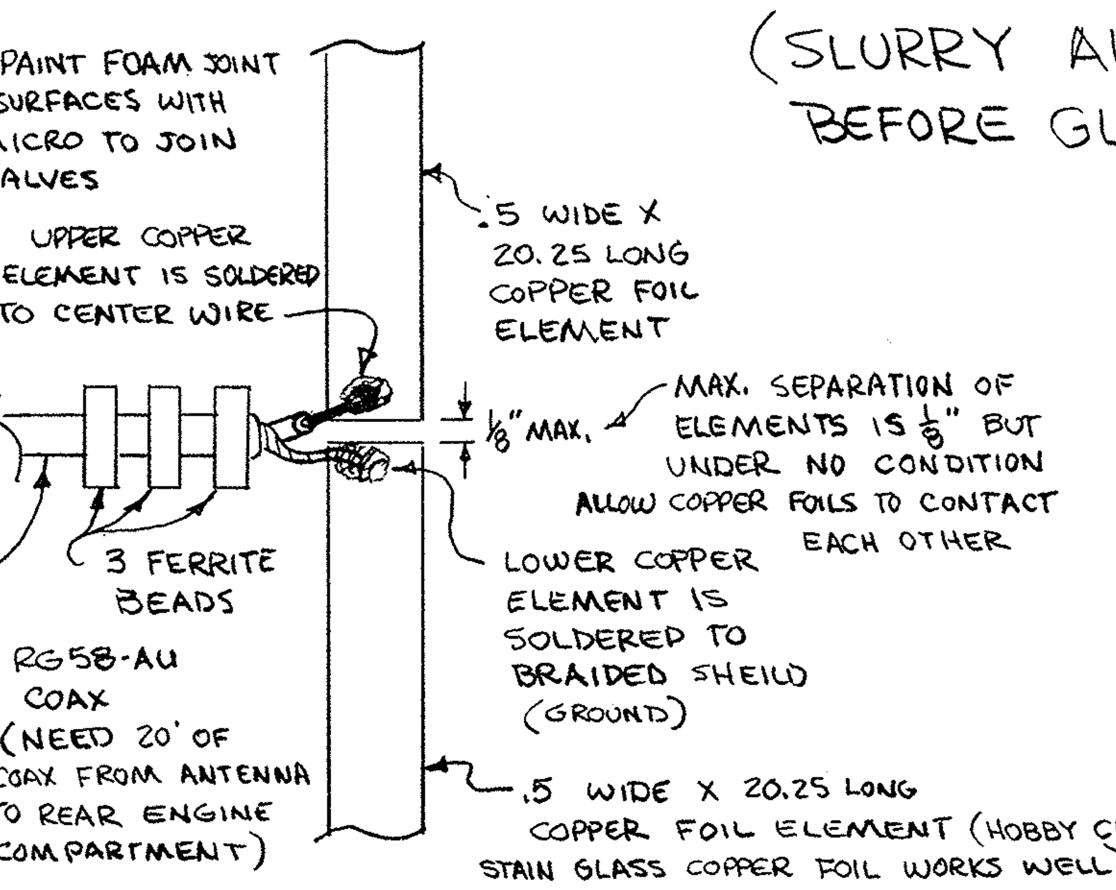
USE JIGS FROM PAGE D-7



DRILL 1/4" HOLE TO ROUTE COAX THRU CENTER OF SPAR. DO NOT HIT SPAR CAPS

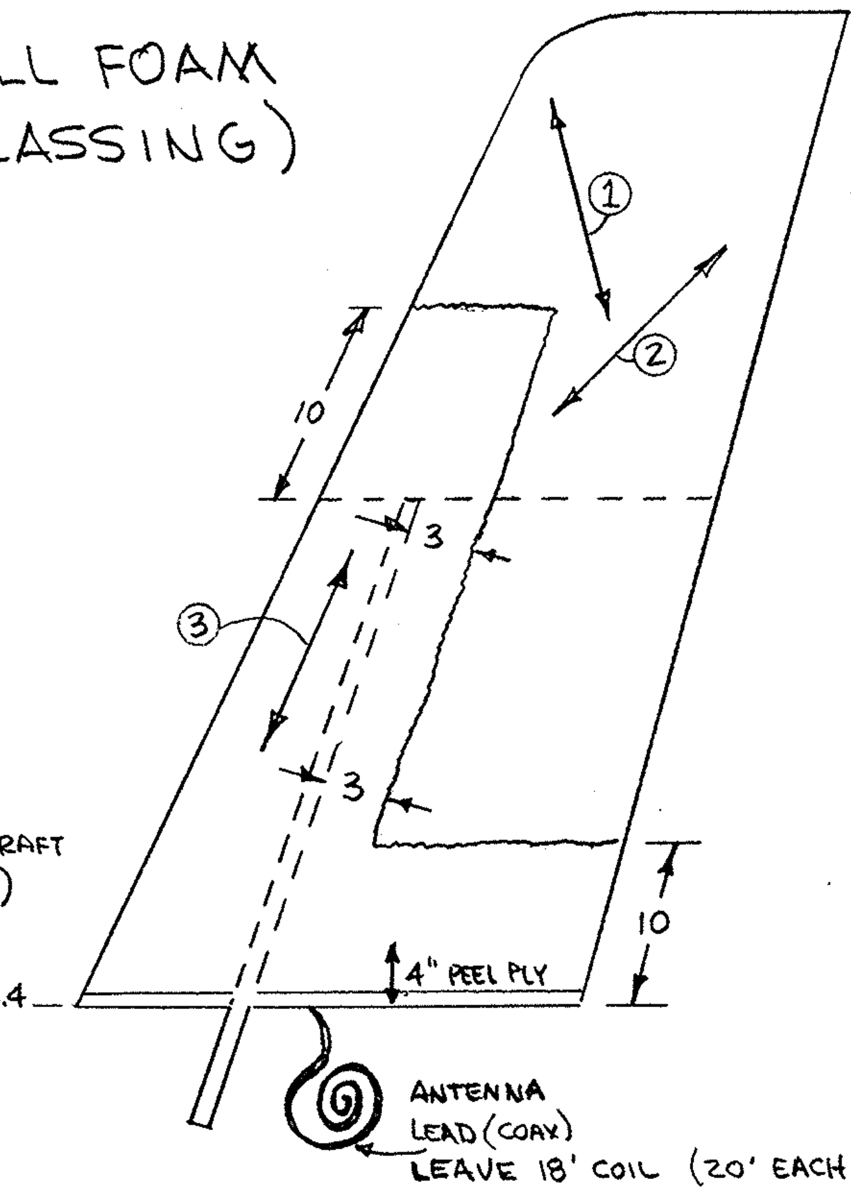

ROUND FOAM CORNER
INSIDE SURFACE OF EACH WINGLET
9
20.25
SEE DETAIL 'A'
20.25
9
FOR BEST ANTENNA PERFORMANCE EXTEND COAX TO L.E. AS SHOWN
SPAR STUB

COAX HAS BEEN ROUTED TO AFT SIDE OF SPAR THOUGH PHOTO'S SHOW IN FRONT - NOTE: WING CONDUIT WAS RELOCATED TO AFT OF SPAR FOR BETTER WIRING PLACEMENT & MAINT. TO STROBES


PAINT FOAM JOINT SURFACES WITH MICRO TO JOIN HALVES
UPPER COPPER ELEMENT IS SOLDERED TO CENTER WIRE
.5 WIDE X 20.25 LONG COPPER FOIL ELEMENT
1/8" MAX.
MAX. SEPARATION OF ELEMENTS IS 1/8" BUT UNDER NO CONDITION ALLOW COPPER FOILS TO CONTACT EACH OTHER
3 FERRITE BEADS
LOWER COPPER ELEMENT IS SOLDERED TO BRAIDED SHEILD (GROUND)
RG58-AU COAX (NEED 20' OF COAX FROM ANTENNA TO REAR ENGINE COMPARTMENT)
.5 WIDE X 20.25 LONG COPPER FOIL ELEMENT (HOBBY CRAFT STAIN GLASS COPPER FOIL WORKS WELL)

COMM. ANTENNA WIRING DETAIL 'A'
(INSTALL ONE IN EACH WINGLET)
(ON INBD. SURFACE)

(SLURRY ALL FOAM BEFORE GLASSING)



WL-55.4

LEAVE 18' COIL (20' EACH WINGLET REQ'D)

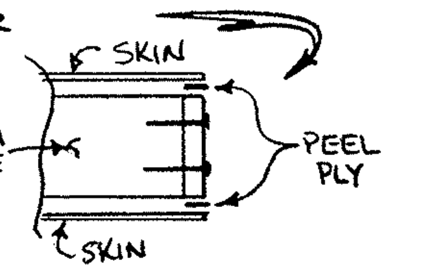
WINGLET SKIN LAYUPS
(DO INBD. SIDE FIRST- SKIN LAYUPS ON BOTH SIDES OF WINGLET ARE THE SAME.

① 1 PLY UND @ -30° TO TRAILING EDGE - FULL SURFACE

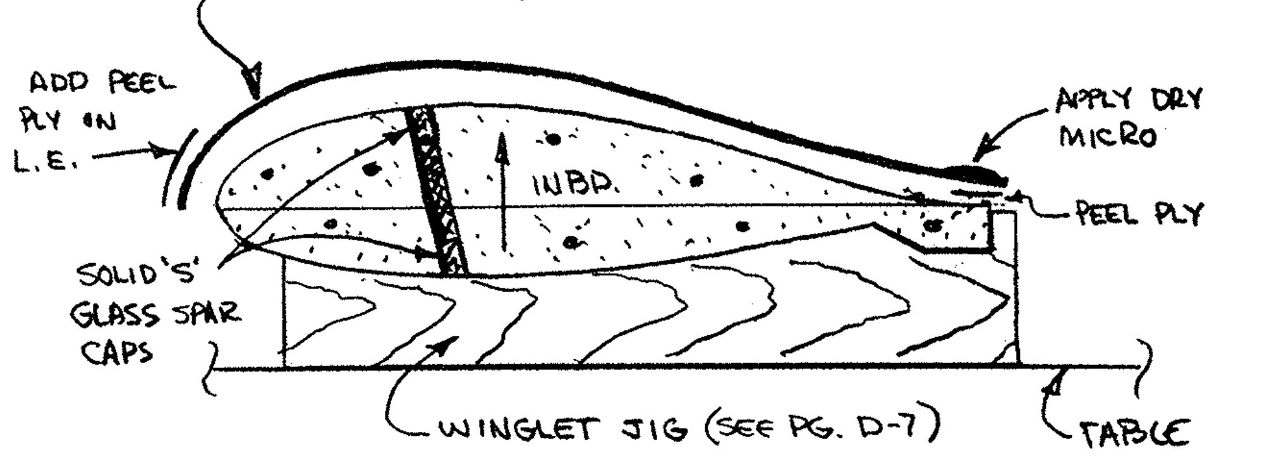
② 1 PLY UND @ +30° TO TRAILING EDGE - FULL SURFACE

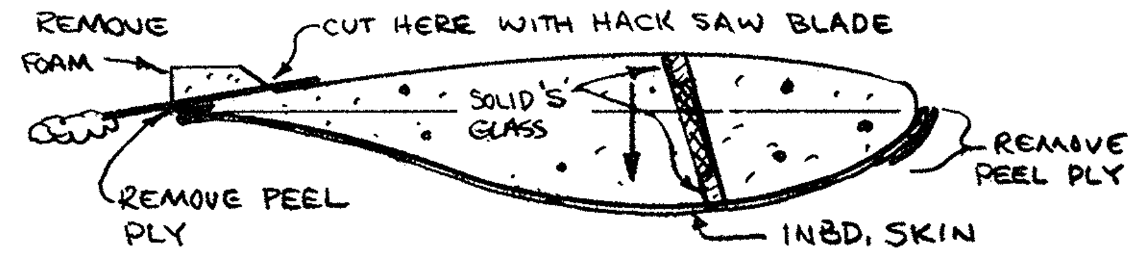
③ 1 PLY UND @ 0° TO LEADING EDGE EXTENDING FROM ROOT (WL 55.4) TO 10" ABOVE FOAM JOINT TO .3" AFT OF SPAR AND FROM L.E. TO T.E. 10" ABOVE ROOT (WL55.4)

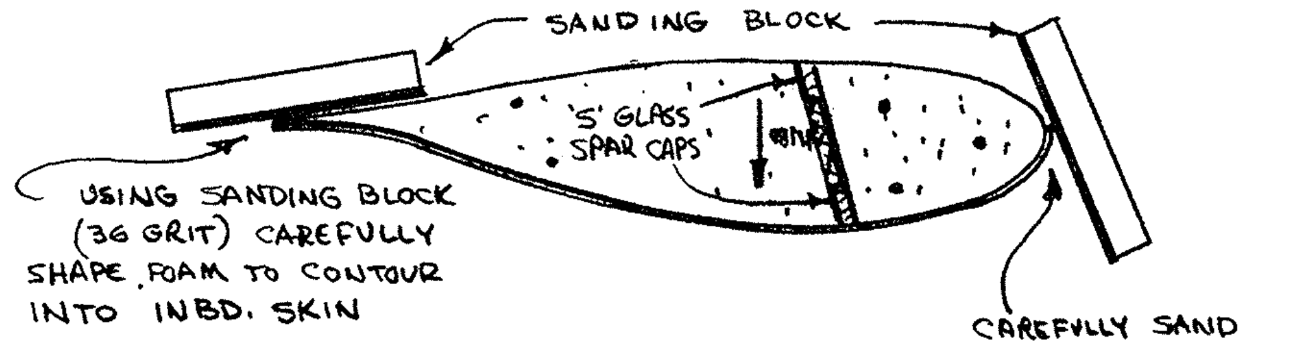
PEEL PLY AREA 4" ABOVE ROOT L.E. TO T.E. AND ALONG L.E.



INBD. SKIN LAYUPS ①②③



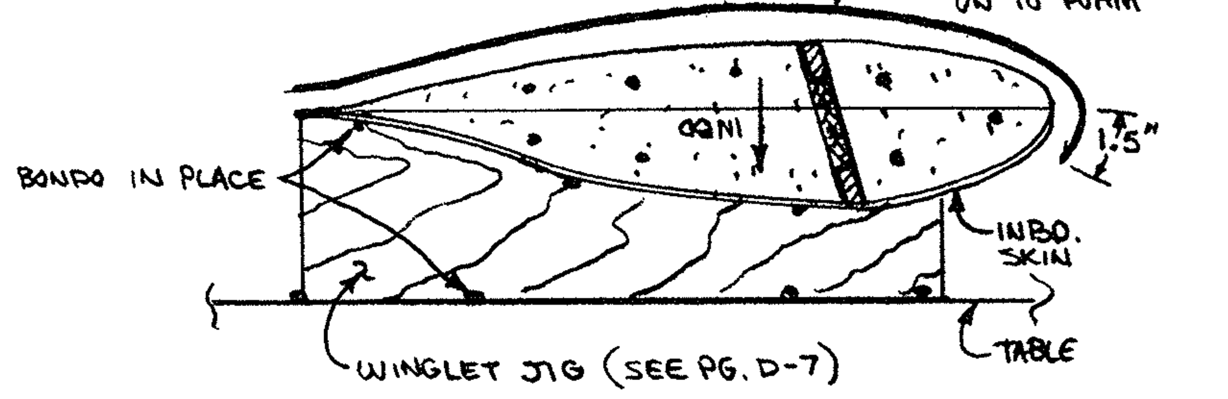


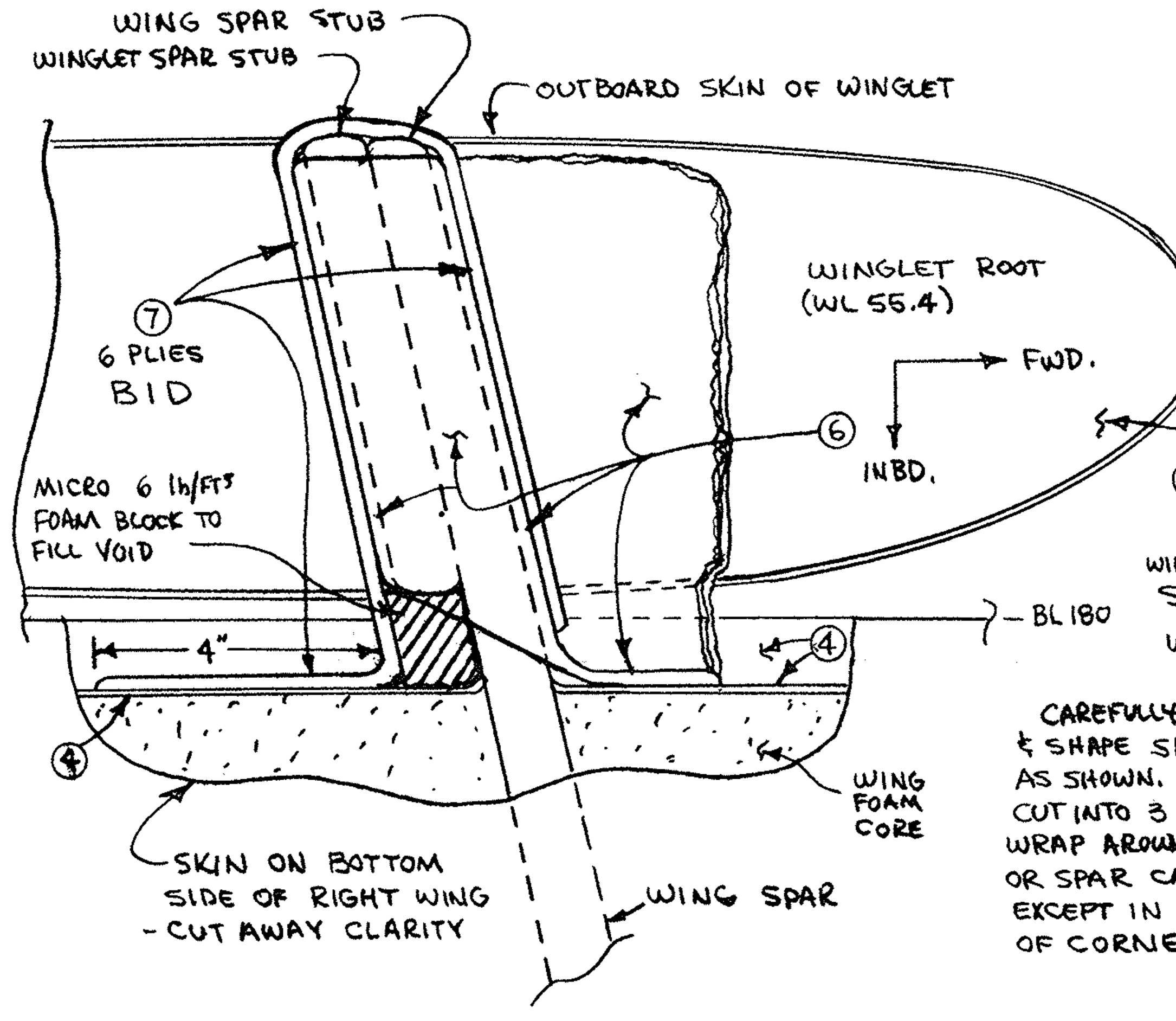


USING SANDING BLOCK (36 GRIT) CAREFULLY SHAPE FOAM TO CONTOUR INTO INBD. SKIN

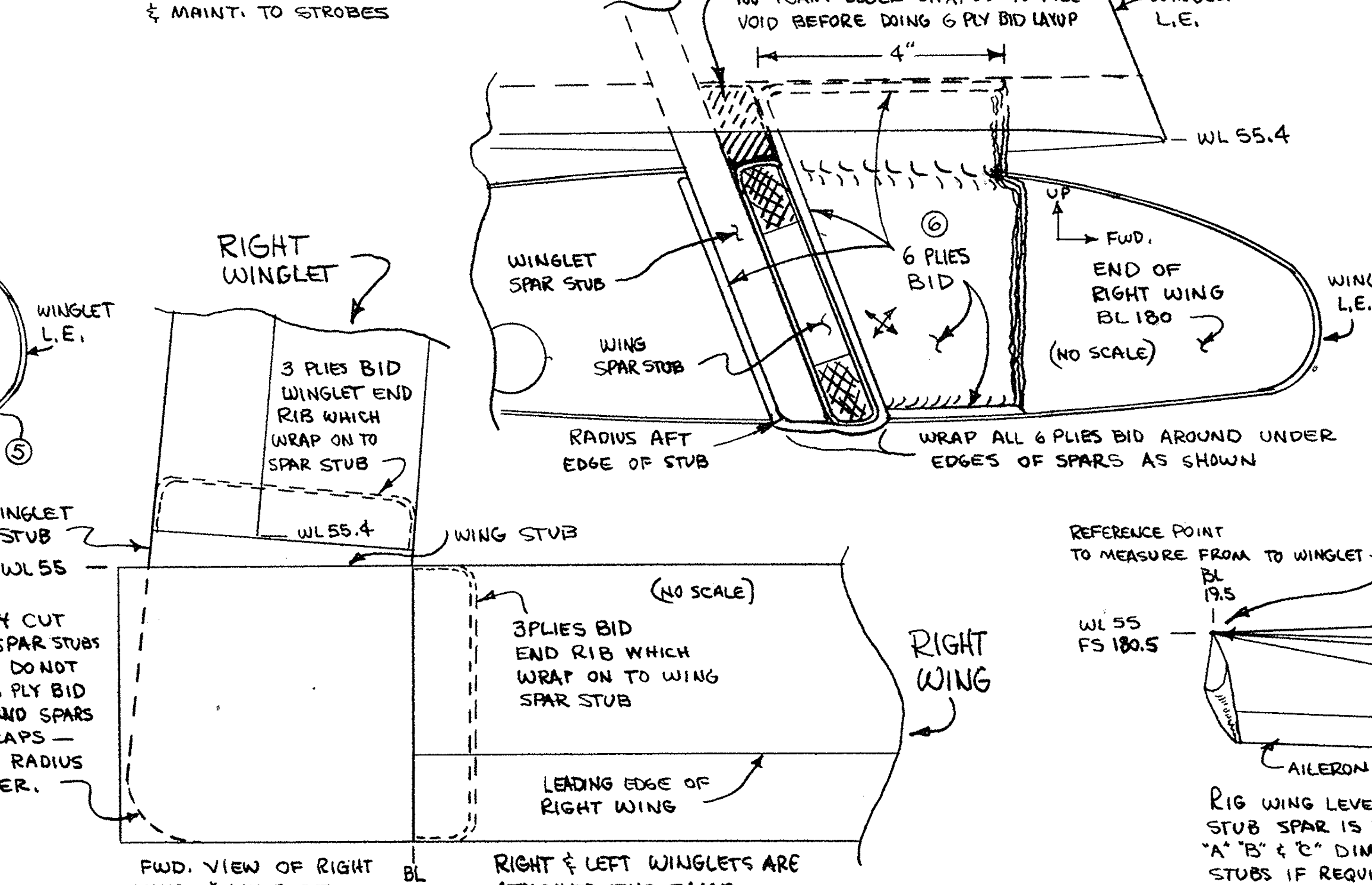
CAREFULLY SAND L.E. GLASS (INBD. SKIN) FOR SMOOTH TRANSITION ON TO FOAM

OTBD. SKIN LAYUPS ①②③





WINGLET ATTACH AS VIEW FROM BOTTOM - WING & WINGLET ARE UPSIDE DOWN


MICRO IN PLACE 6 lb/ft³ TYPE 100 FOAM BLOCK SHAPED TO FILL VOID BEFORE DOING 6 PLY BID LAYUP
WINGLET L.E.
4"
WL 55.4
WINGLET SPAR STUB
⑥
6 PLIES BID
UP
FWD.
END OF RIGHT WING BL 180
(NO SCALE)
WING L.E.
WING SPAR STUB
RADIUS AFT EDGE OF STUB
WRAP ALL 6 PLIES BID AROUND UNDER EDGES OF SPARS AS SHOWN
RIGHT WINGLET
3 PLIES BID WINGLET END RIB WHICH WRAP ON TO SPAR STUB
WINGLET STUB
WL 55
WL 55.4
WING STUB
(NO SCALE)
3 PLIES BID END RIB WHICH WRAP ON TO WING SPAR STUB
RIGHT WING
LEADING EDGE OF RIGHT WING
CAREFULLY CUT & SHAPE SPAR STUBS AS SHOWN. DO NOT CUT INTO 3 PLY BID WRAP AROUND SPARS OR SPAR CAPS — EXCEPT IN RADIUS OF CORNER.

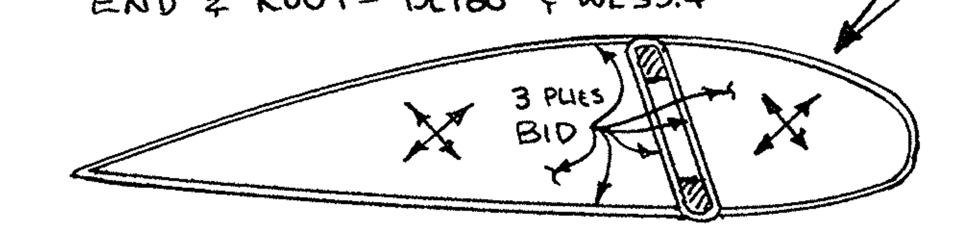
FWD. VIEW OF RIGHT WING & WINGLET ATTACHING SPAR STUBS

BL 180

RIGHT & LEFT WINGLETS ARE ATTACHED THE SAME

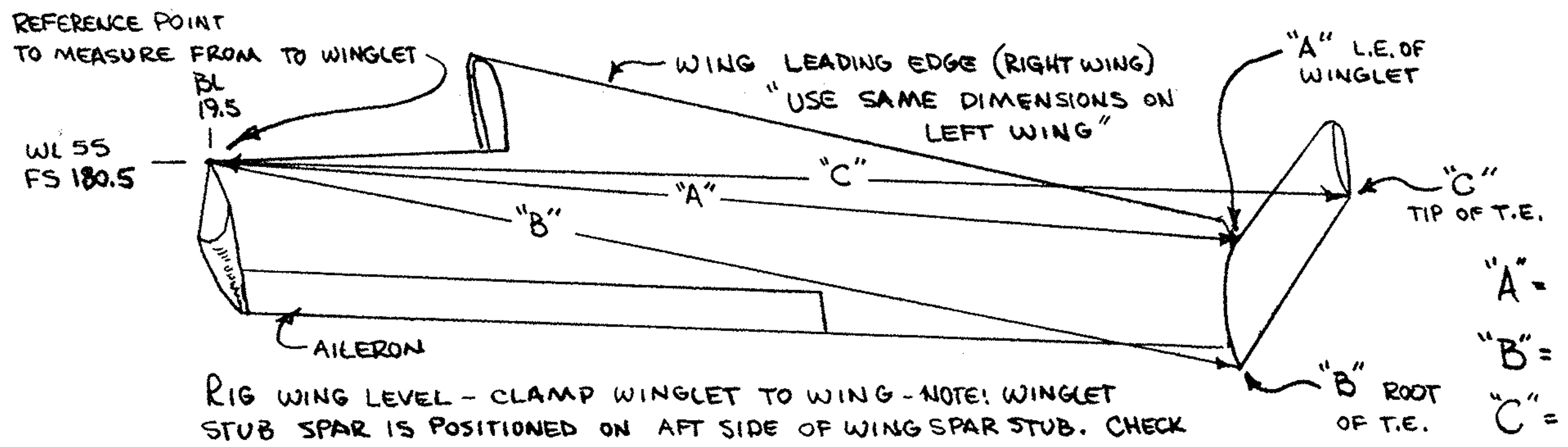
④ END OF WING RIB LAYUP (3 BID)
⑤ END OF WINGLET RIB LAYUP (3 BID)

EXAMPLE OF WING & WINGLET END & ROOT- BL180 & WL55.4



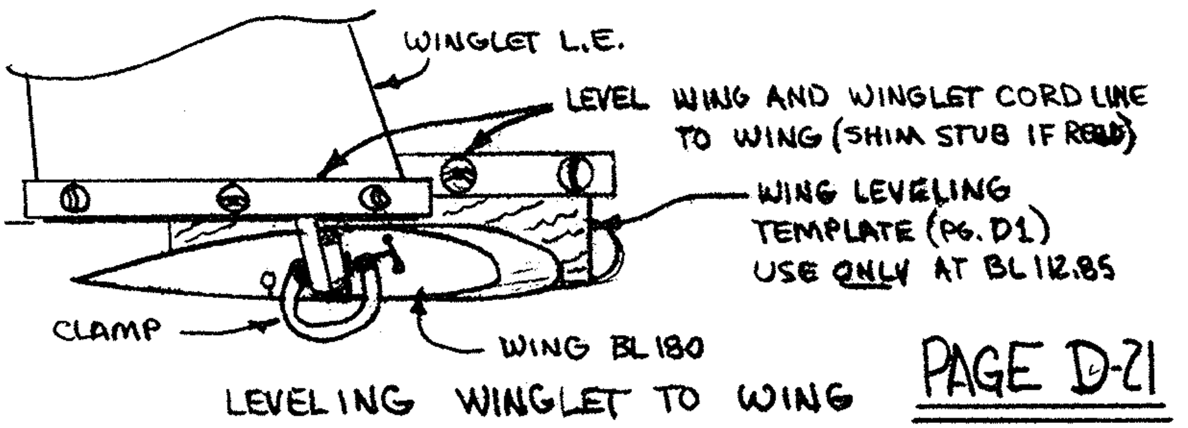
REMOVE .7" FOAM ON END OF WING (BL 180) & WINGLET ROOT (WL-55.4) AND REMOVE PEEL PLY FROM INSIDE SURFACE OF SKINS. SLURRY FOAM AND APPLY 3 PLIES BID @45° TO WING END (BL180) & 3 PLIES BID @45° TO WINGLET ROOT (WL 55.4) WRAPPING THE 3 PLIES BID COMPLETELY ON TO AND AROUND ENTIRE SURFACES OF EACH CORRESPONDING SPAR STUB - ALLOW CURE & TRIM EDGES. NOTE: CAREFULLY RADIUS EDGES OF SPAR STUBS TO ALLOW EASY CONTOUR OF 3 PLIES BID

JIGGING WINGLET TO WING

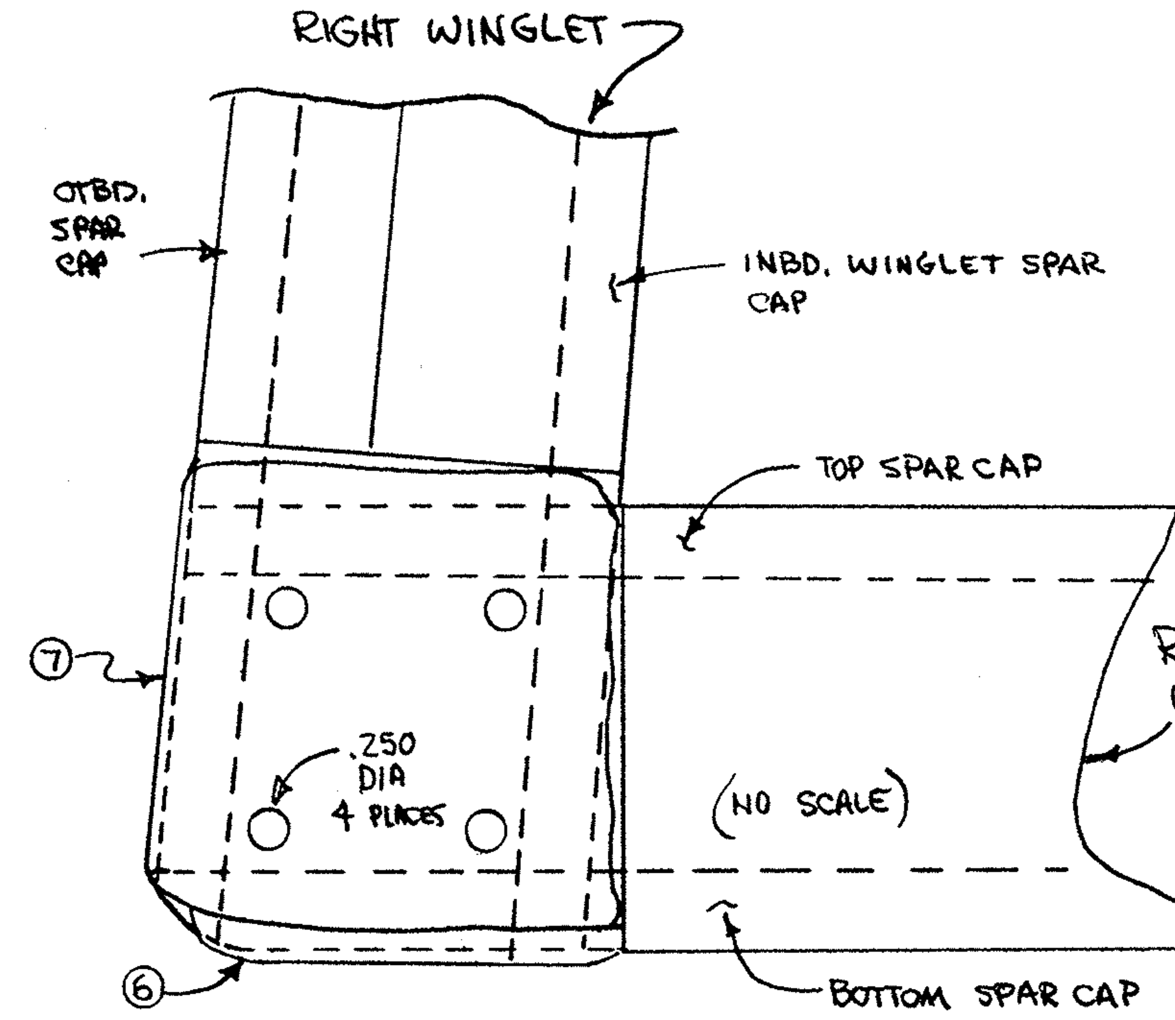

REFERENCE POINT TO MEASURE FROM TO WINGLET
BL 19.5
WL 55
FS 180.5
WING LEADING EDGE (RIGHT WING) "USE SAME DIMENSIONS ON LEFT WING"
"A" L.E. OF WINGLET
"C"
"A"
"B"
"C" TIP OF T.E.
"B" ROOT OF T.E.
AILERON

"A" = 169.19"
"B" = 177.27"
"C" = 185.93"

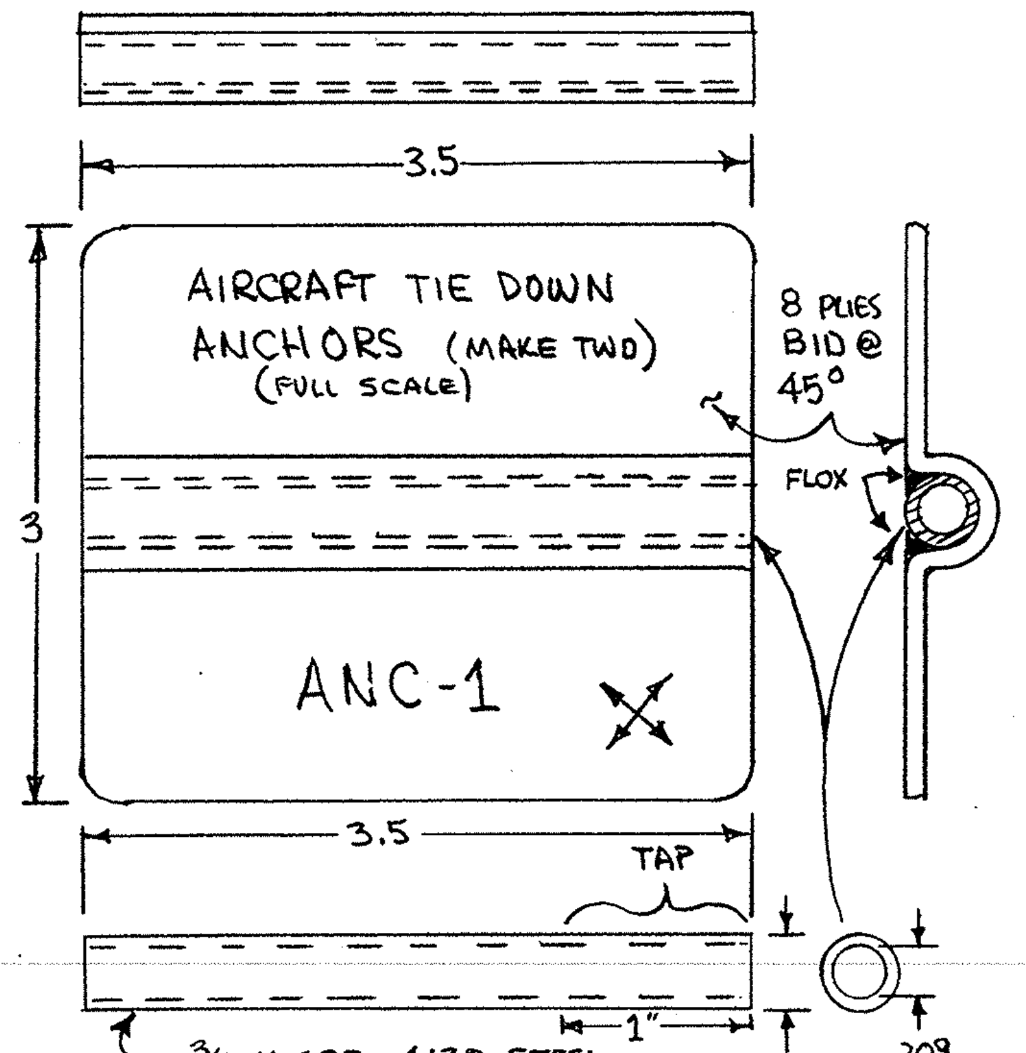
RIG WING LEVEL - CLAMP WINGLET TO WING - NOTE: WINGLET STUB SPAR IS POSITIONED ON AFT SIDE OF WING SPAR STUB. CHECK "A" "B" & "C" DIMENSIONS & SHIM BETWEEN WING & WINGLET SPAR STUBS IF REQUIRED WITH BID WEDGES TO OBTAIN ACCURATE "A" "B" "C" MEASUREMENTS. AFTER NOTING WEDGE REQUIREMENTS, UNCLAMP & APPLY FLOX WITH NO VOIDS TO BOTH MATING STUBS - REINSTALL WEDGES IF REQ'D. TO ADJUST FOR "A" "B" "C" DIMENSIONS - CLAMP & ALLOW 24 HR. CURE.


WINGLET L.E.
LEVEL WING AND WINGLET CORD LINE TO WING (SHIM STUB IF REQ'D)
WING LEVELING TEMPLATE (PG. D1) USE ONLY AT BL 112.85
WL 55.4
CLAMP
WING BL 180

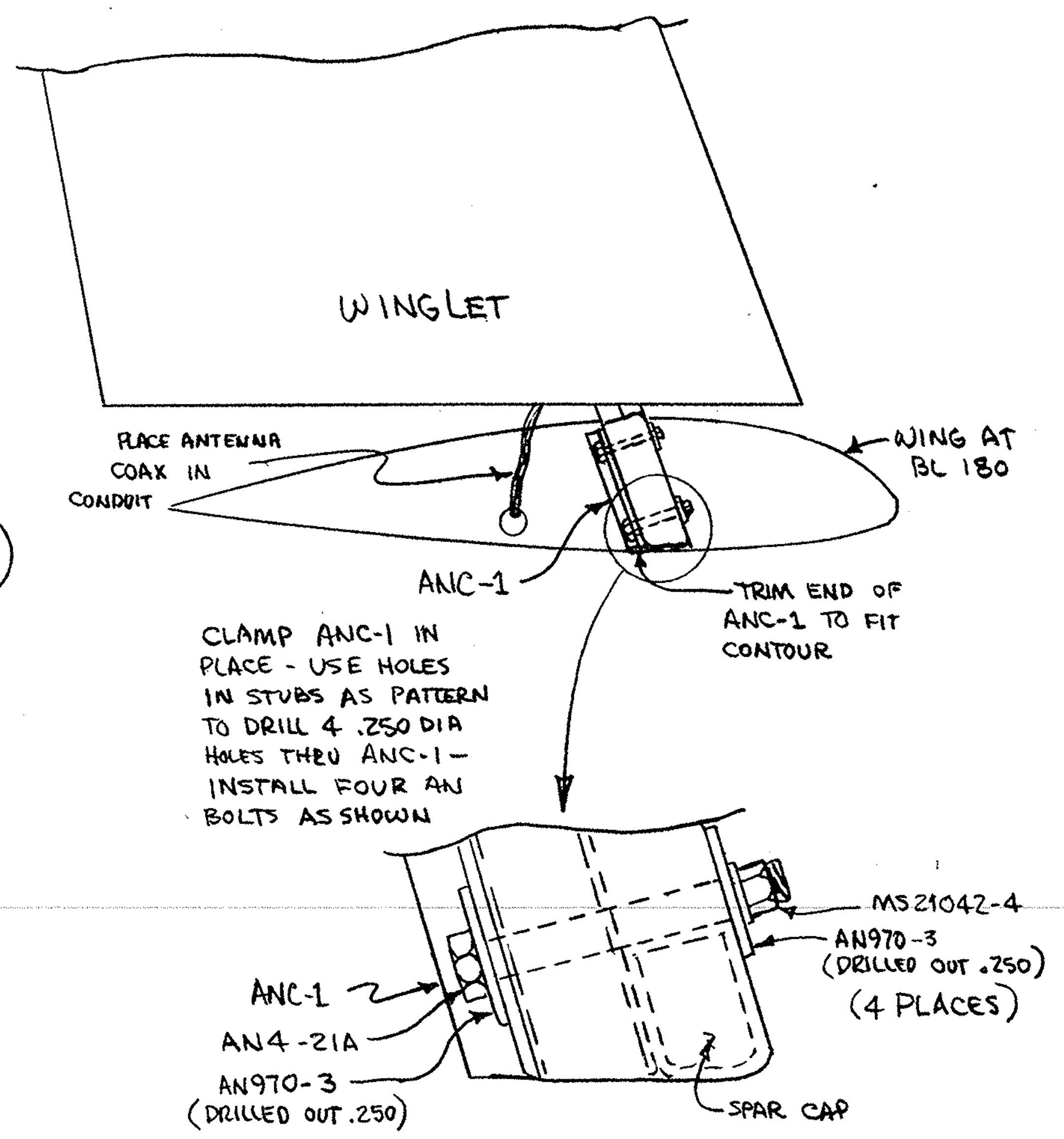
LEVELING WINGLET TO WING



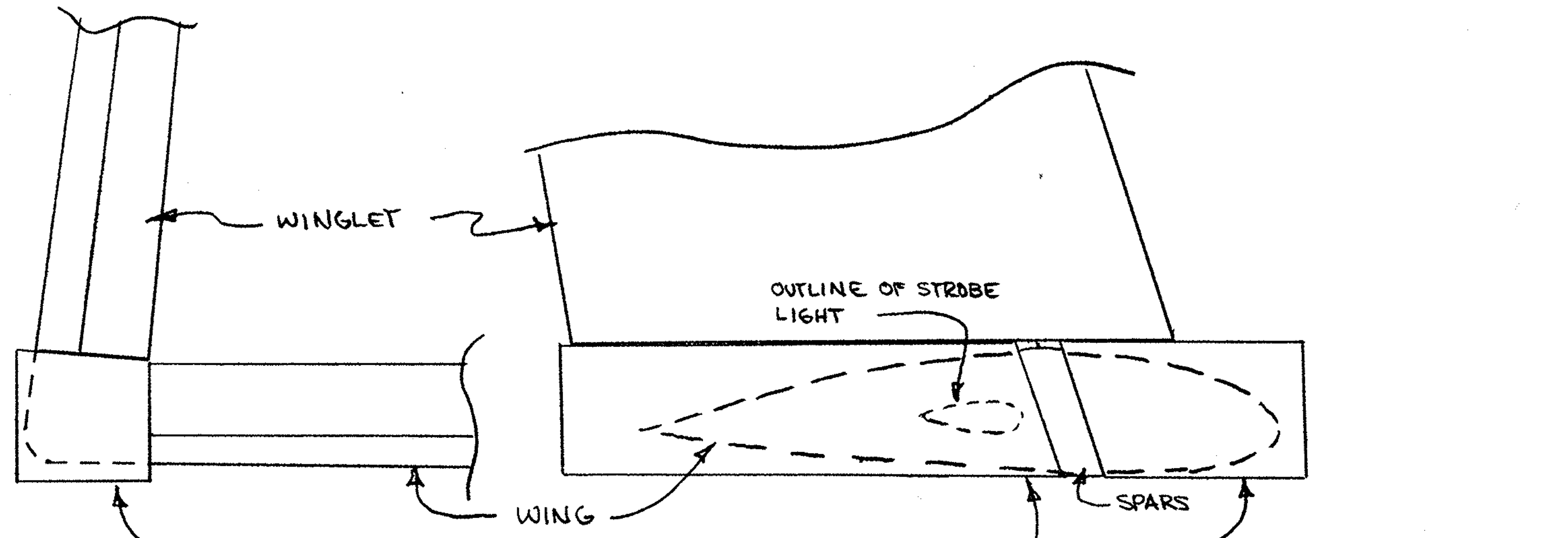
AFTER COMPLETING LAYUPS ⑥ & ⑦ DRILL 4 .250 DIA HOLES THRU BOTH SPAR STUBS AS SHOWN - CAUTION DUE TO ANGLES INVOLVED, CAREFULLY CHECK BOTH SIDES BEFORE DRILL TO AVOID HITTING ANY SPAR CAP.



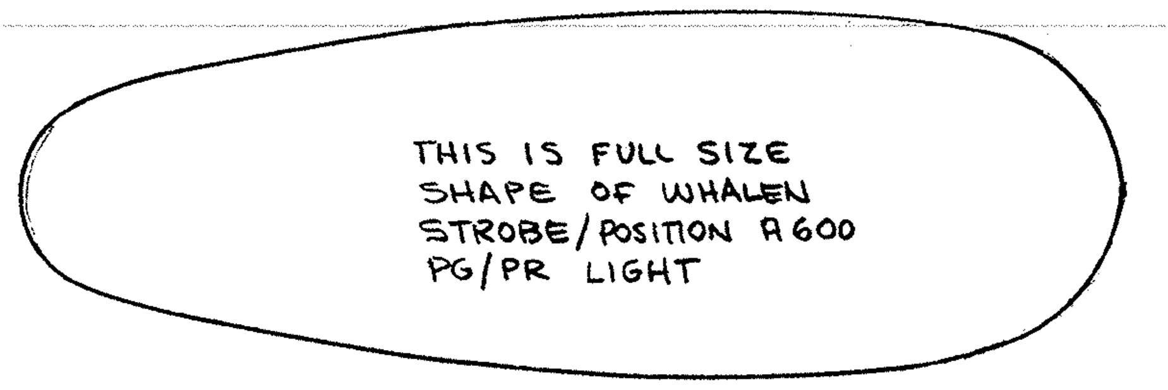
3/8 X.083 4130 STEEL TAPPED ON ONE END WITH (1/4 - 28 NF) - 1.0" DEEP ROUGH OUTER SURFACE WITH FILE.


WINGLET
PLACE ANTENNA COAX IN CONDUIT
WING AT BL 180
ANC-1
TRIM END OF ANC-1 TO FIT CONTOUR
MS21042-4
AN970-3 (DRILLED OUT .250)
(4 PLACES)
ANC-1
AN4-21A
AN970-3 (DRILLED OUT .250)
SPAR CAP

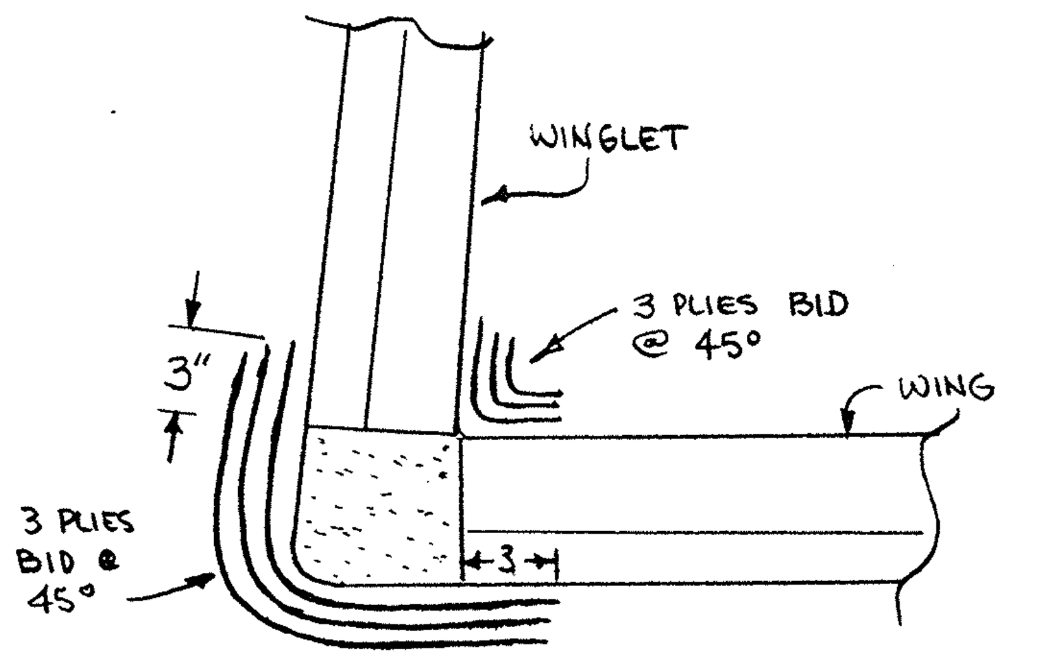
CLAMP ANC-1 IN PLACE - USE HOLES IN STUBS AS PATTERN TO DRILL 4 .250 DIA HOLES THRU ANC-1 - INSTALL FOUR AN BOLTS AS SHOWN



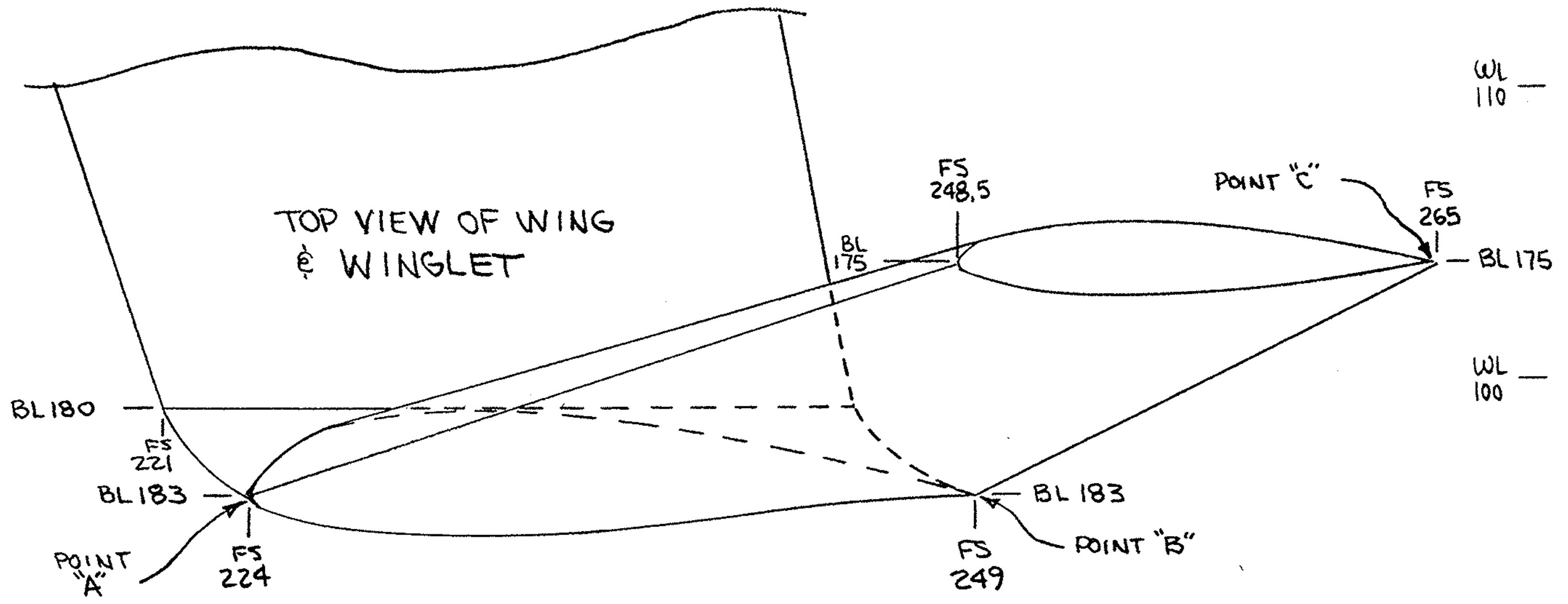
MICRO IN PLACE BLOCKS OF 2 lb/ft³ URETHANE OR USE POUR IN PLACE (X-40 URETHANE) FOAM - FILL IN ALL VOIDS - SHAPE FOAM TO SMOOTH TRANSITION FROM WING TO WINGLET. CONTOUR A SURFACE ON FOAM TO ATTACH STROBE & POSITION LIGHT BEFORE DOING FINAL LAYUP

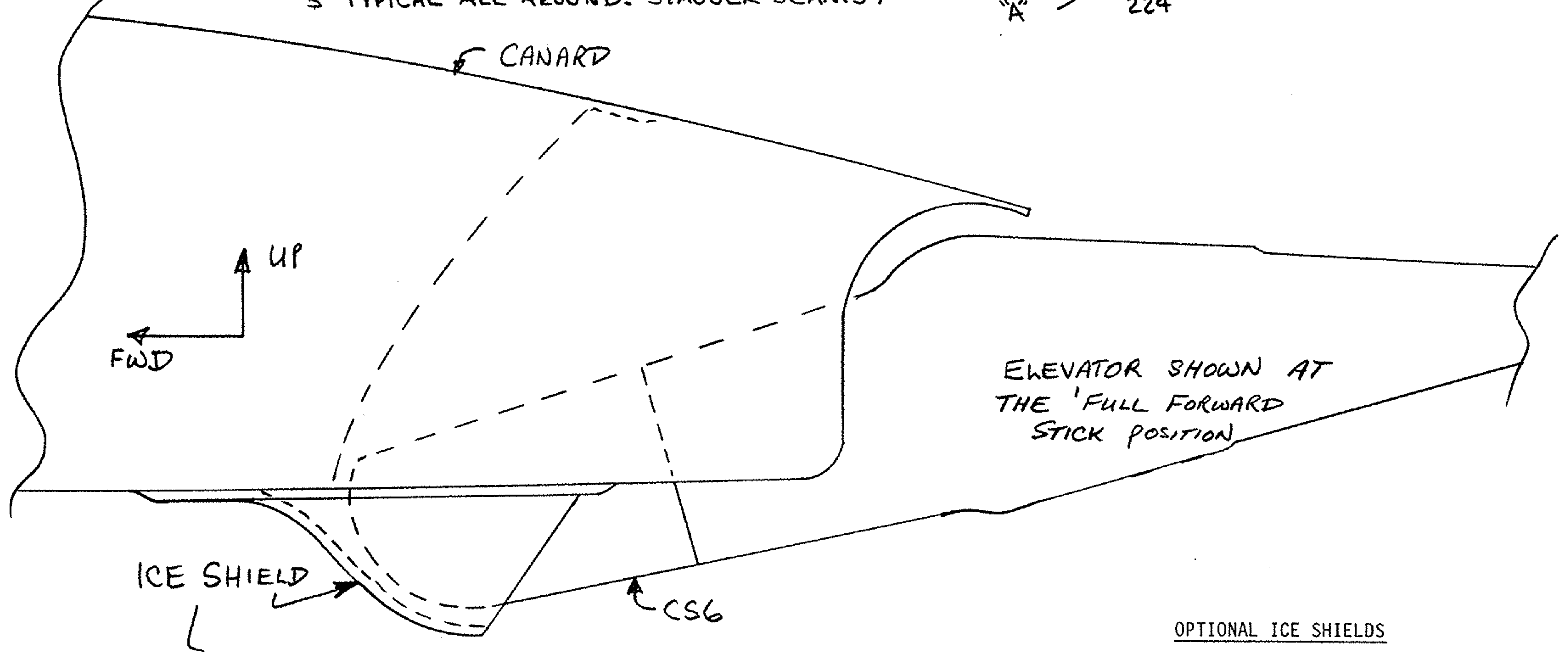


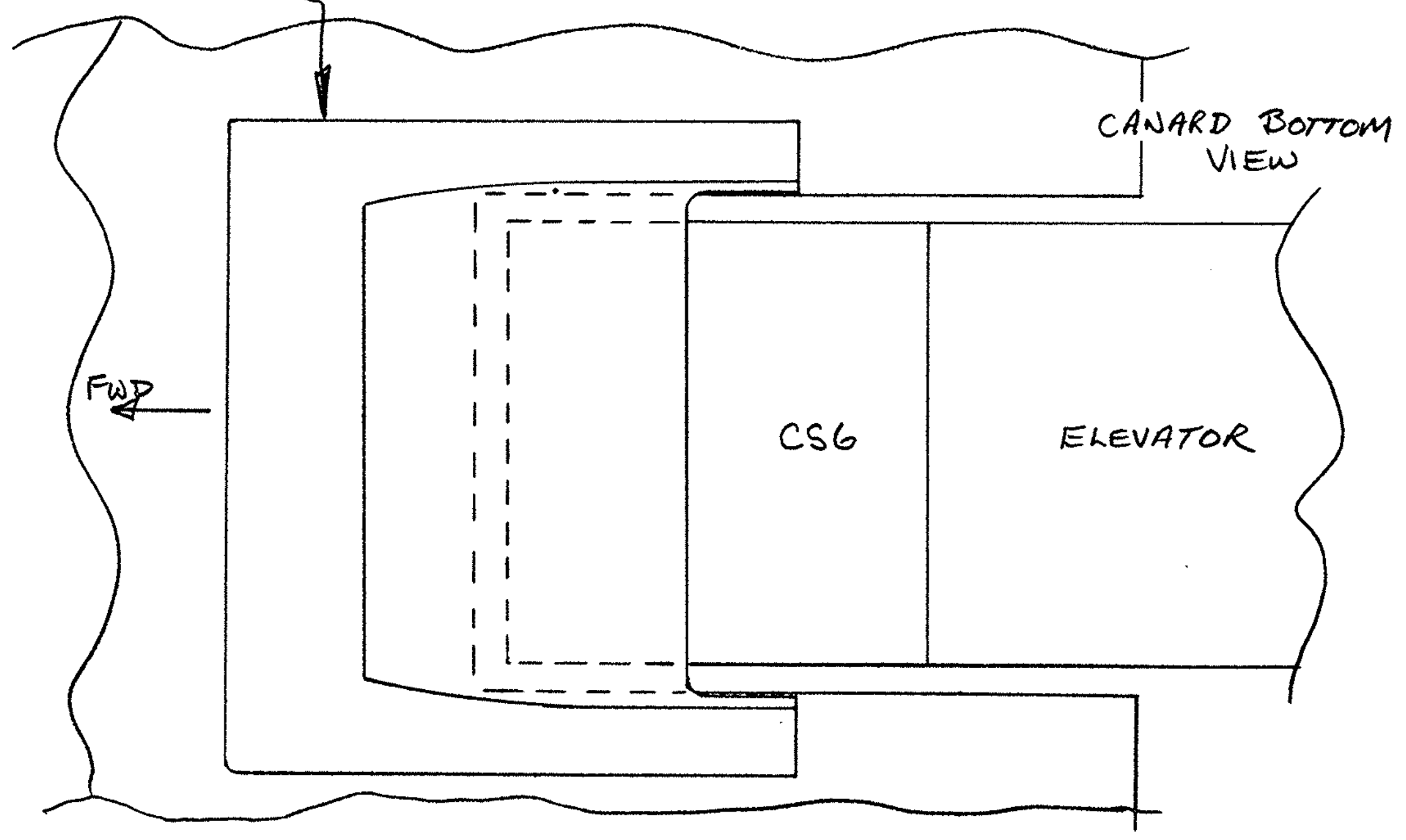
THIS IS FULL SIZE SHAPE OF WHALEN STROBE/POSITION A600 PG/PR LIGHT



COVER ENTIRE FOAM SURFACE WITH 3 PLIES BID @ 45° LAPPING ONTO WING & WINGLET 3" TYPICAL ALL AROUND. STAGGER SEAMS.





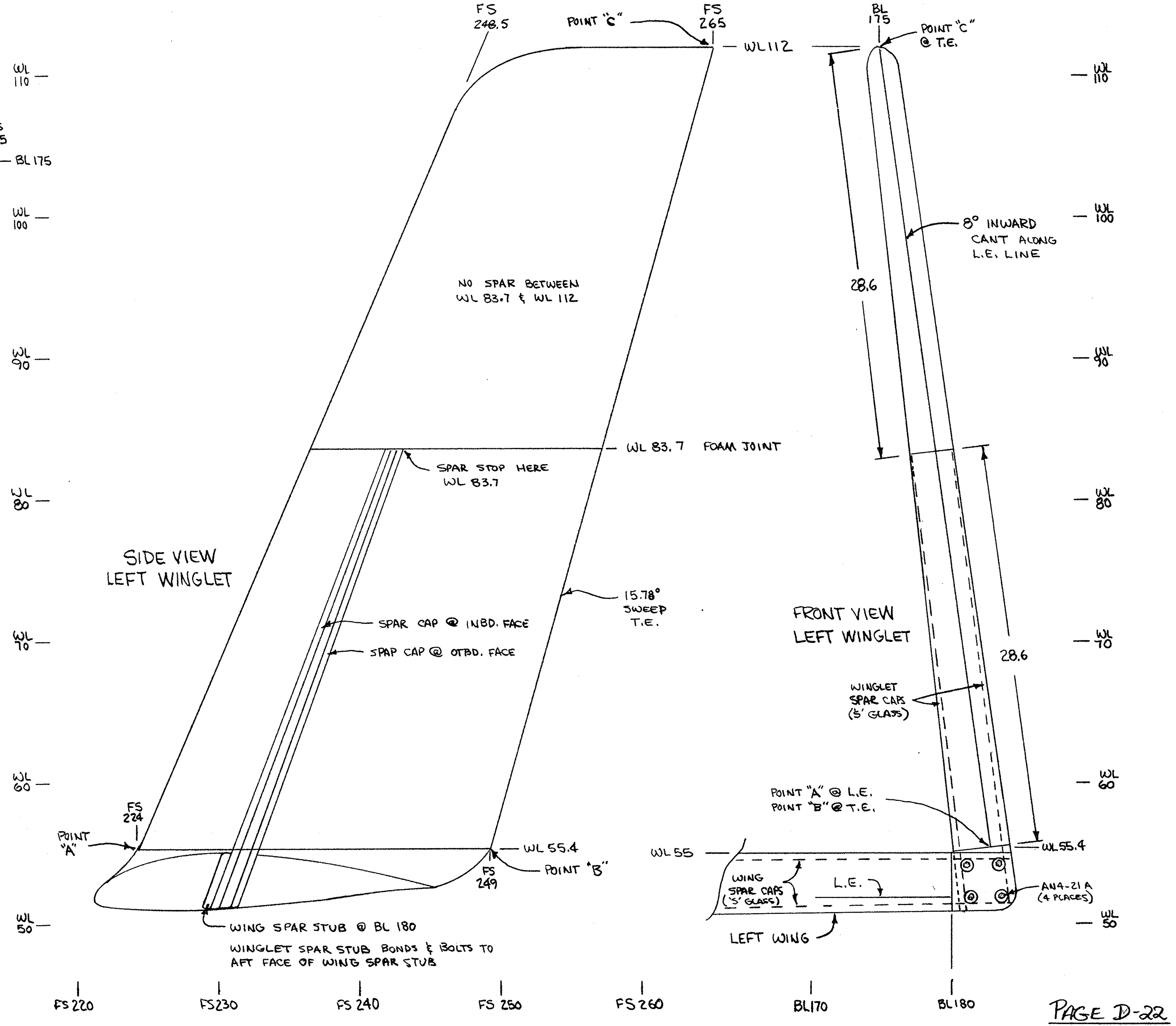


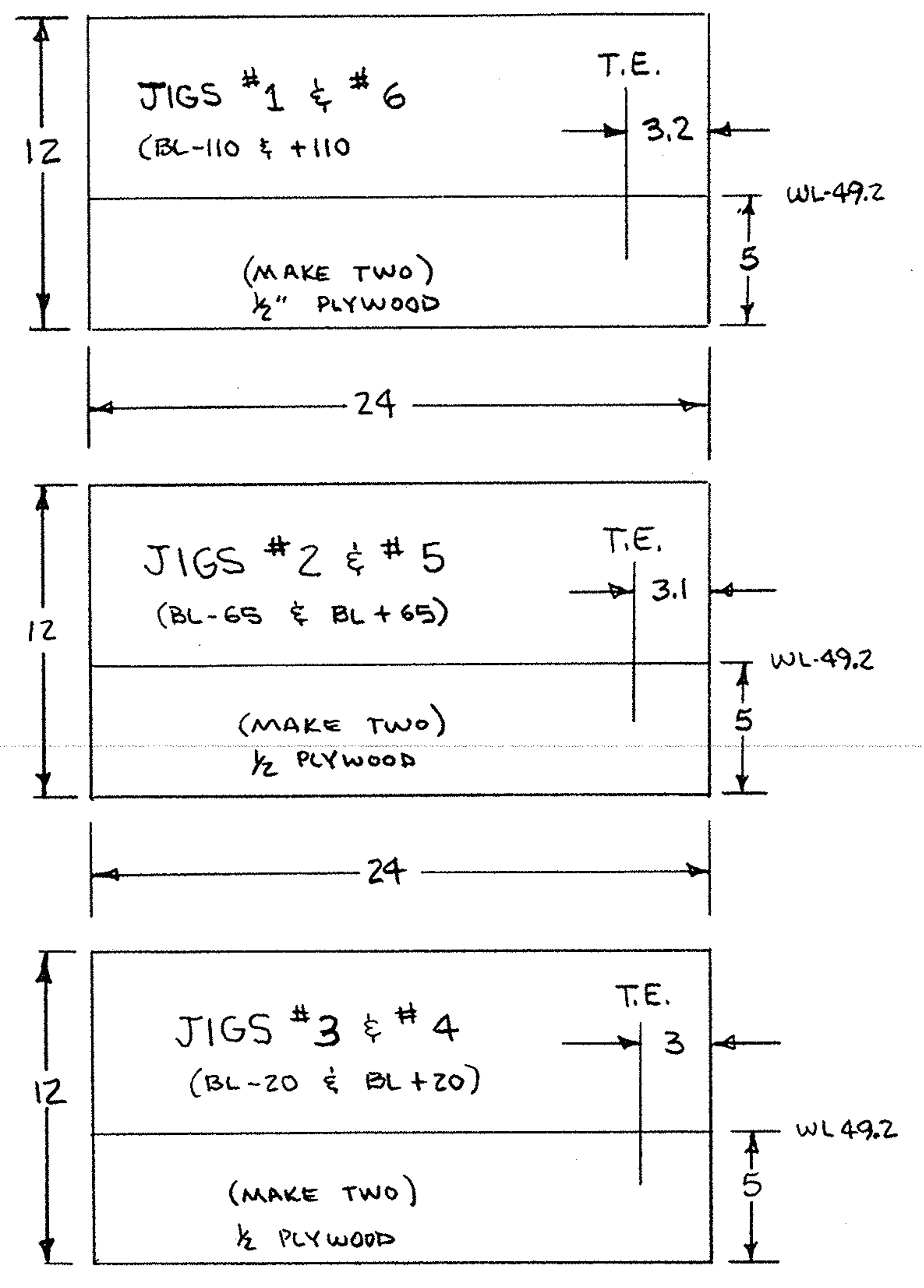
OPTIONAL ICE SHIELDS

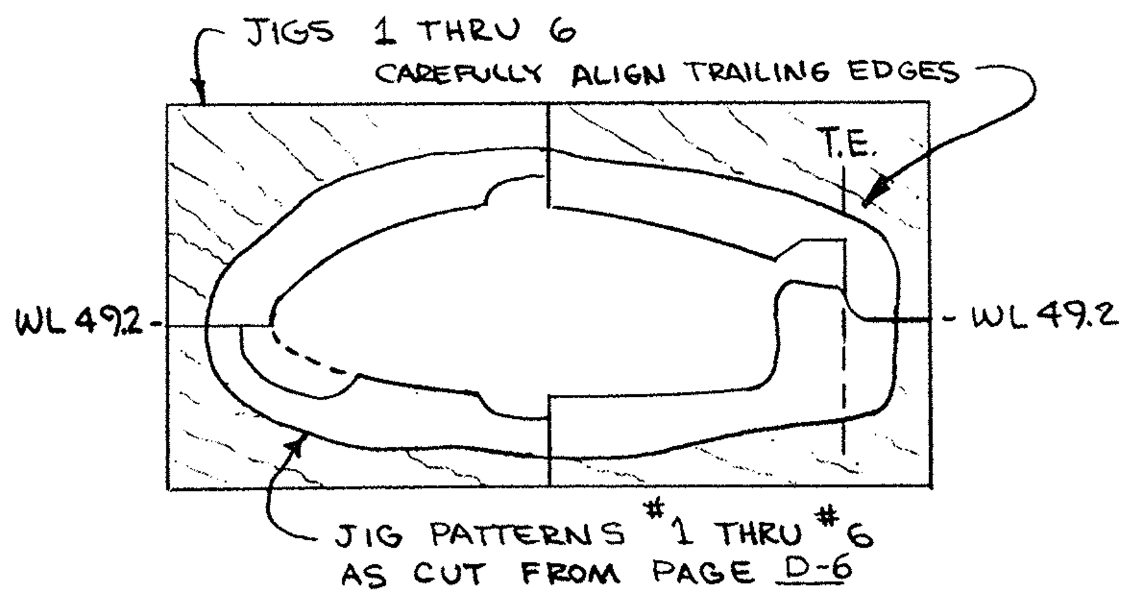
Like many light aircraft, the Defiant is not approved for flight into known icing conditions. However, we do have limited light icing experience in the prototype Defiant. We found the aircraft handled light rhime with no discernable trim changes. However, we have found that ice forms on the blunt leading edges of the outboard elevator balance weight, and could restrict elevator travel. We installed ice shields on the prototype Defiant to correct this problem.

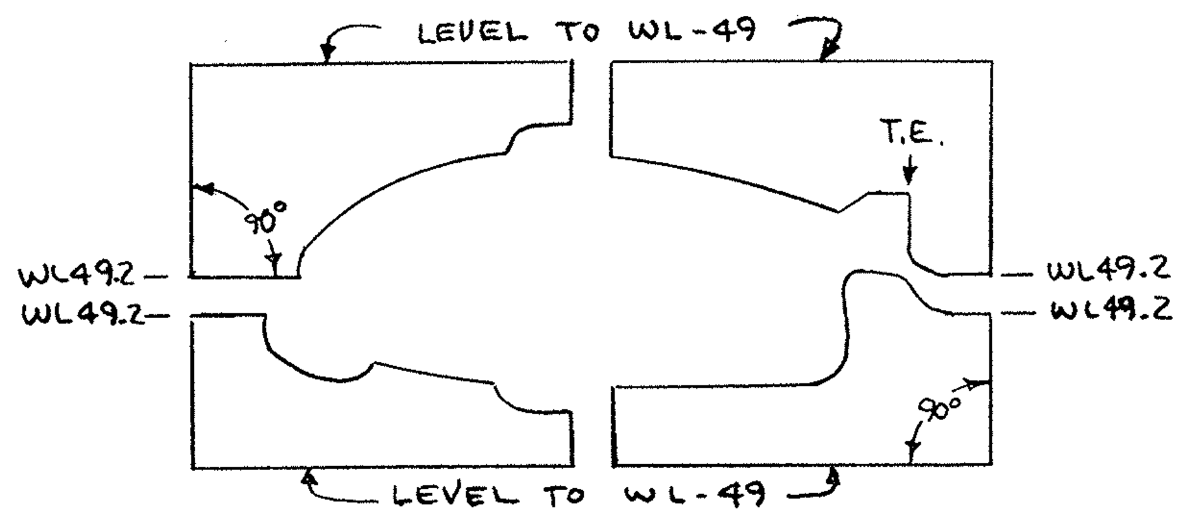
If you are contemplating IFR operation of your Defiant, you should install the ice shields detailed here. They are merely a 3 ply BID shield in front of the balance weight.

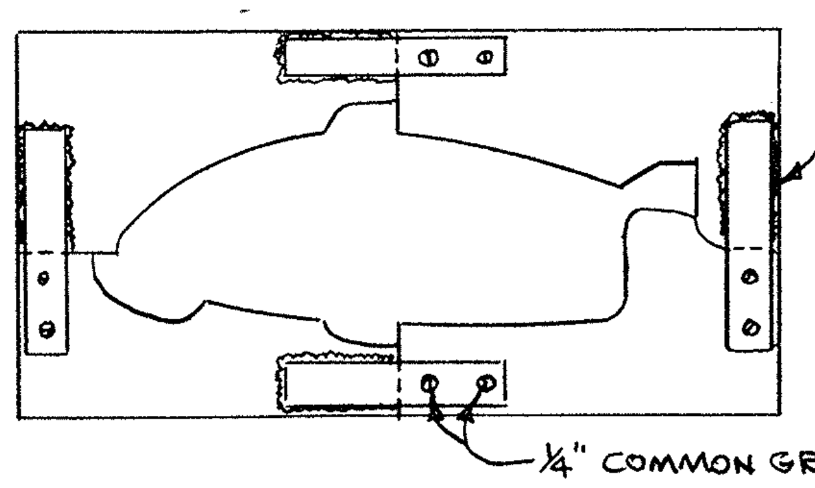
Wait until after the feather fill application so the shields don't interrupt your ability to smoothly contour the canard surface. Install the elevator with 2 hinge screws. Tape it in the full forward stick position shown. Sand away any feather fill down to bare glass on the canard skin out to 1/2" from the balance weight. Apply at least 12 thicknesses of grey duct-tape to the balance weight sides and front to provide clearance. Then layup 3 plies BID as shown over the weight lapping 1/2" onto the canard skin. After cure, remove elevator and grey tape.



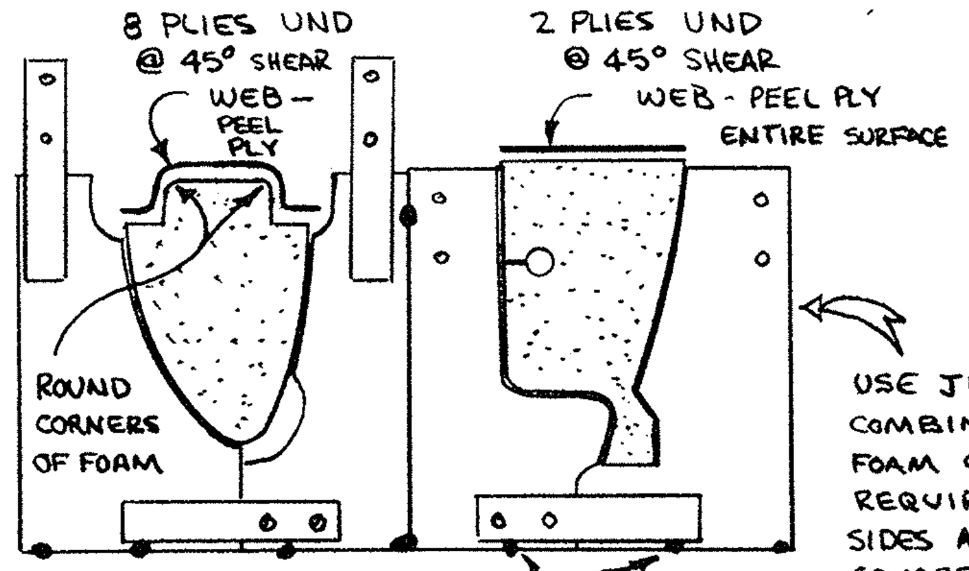








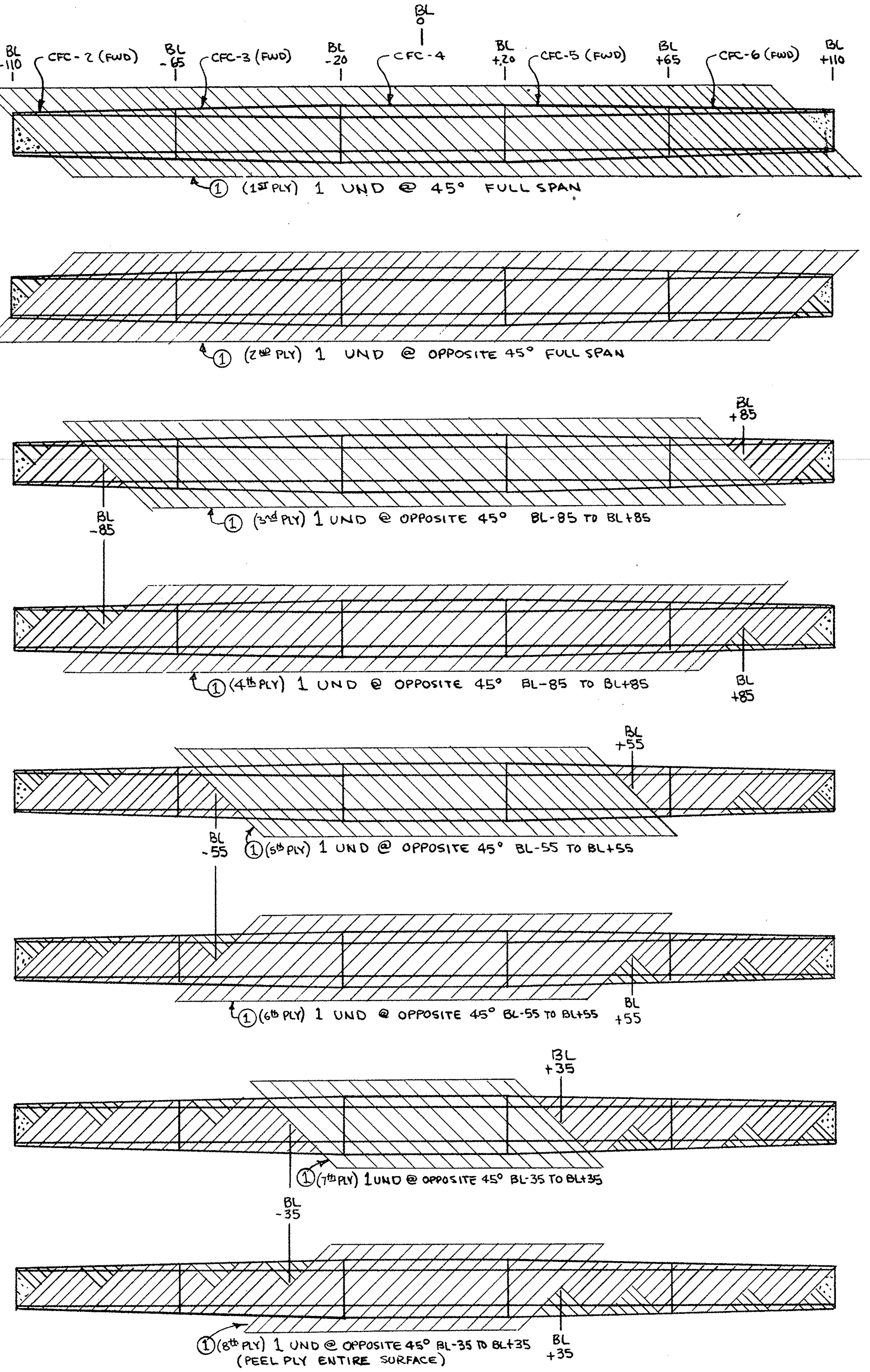
WHITE GLUE ½"X 1.5"X 8"L TO JIG WITH ¼" STOVE BOLTS HOLDING OTHER END



BONDO TO TABLE

SECTION A-A

USE JIGS IN DIFFERENT COMBINATIONS TO RIG FOAM CORES INTO ALL REQUIRED POSITIONS. ALL SIDES ARE LEVEL OR SQUARE TO WL-49



① (1ST PLY) 1 UND @ 45° FULL SPAN

① (2ND PLY) 1 UND @ OPPOSITE 45° FULL SPAN

① (3rd PLY) 1 UND @ OPPOSITE 45° BL-85 TO BL+85

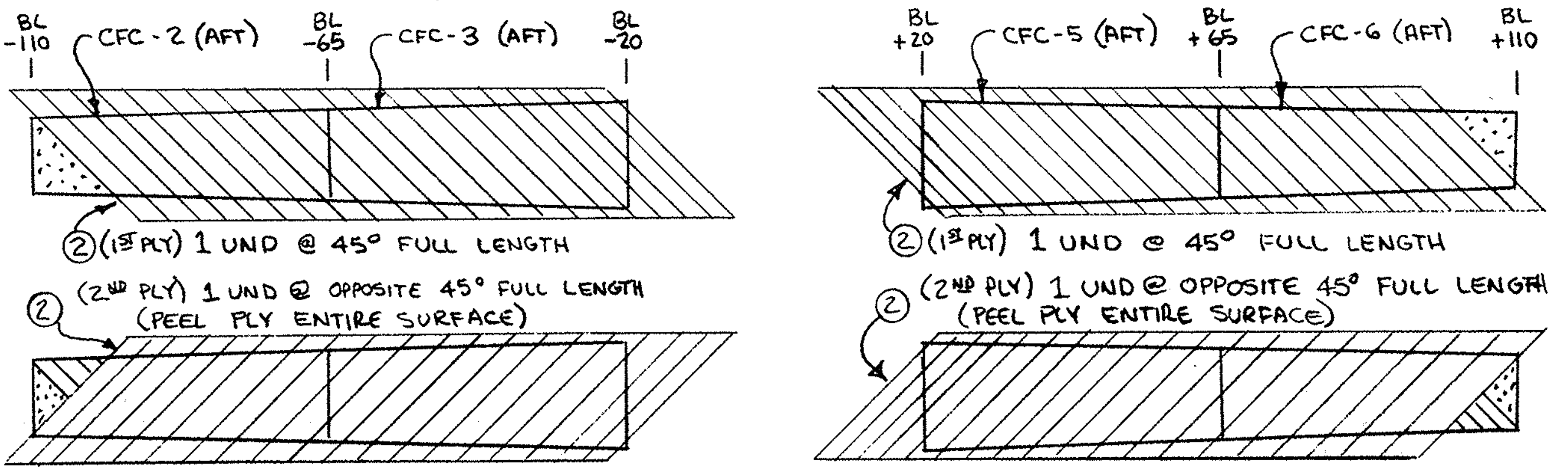
① (4th PLY) 1 UND @ OPPOSITE 45° BL-85 TO BL+85

① (5th PLY) 1 UND @ OPPOSITE 45° BL-55 TO BL+55

① (6th PLY) 1 UND @ OPPOSITE 45° BL-55 TO BL+55

① (7th PLY) 1 UND @ OPPOSITE 45° BL-35 TO BL+35

① (8th PLY) 1 UND @ OPPOSITE 45° BL-35 TO BL+35 (PEEL PLY ENTIRE SURFACE)

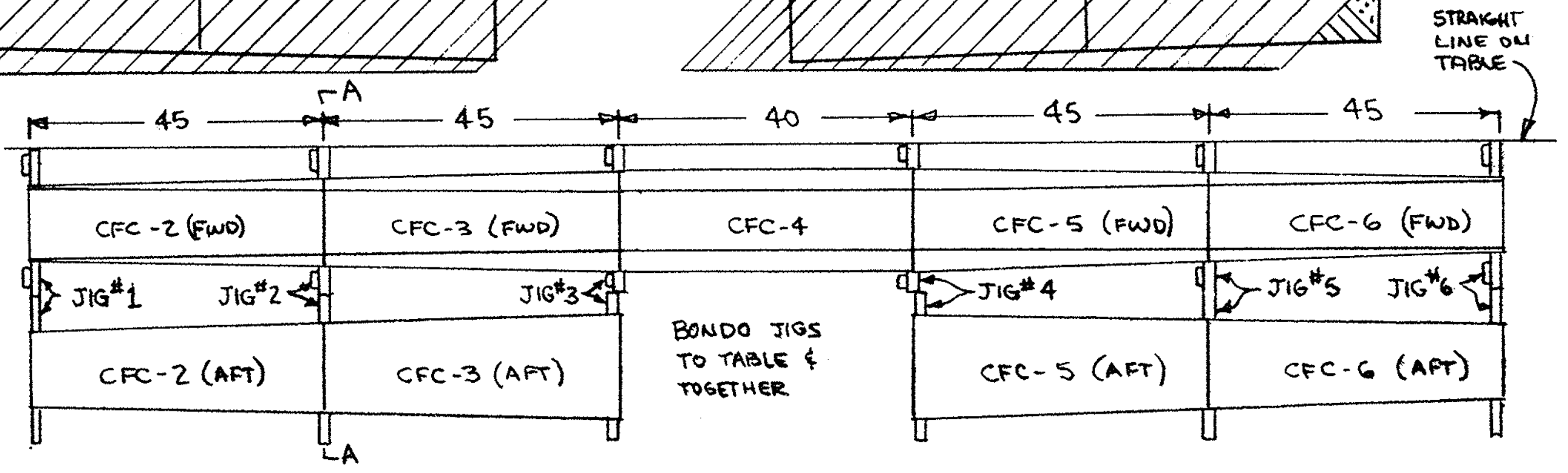


② (1ST PLY) 1 UND @ 45° FULL LENGTH

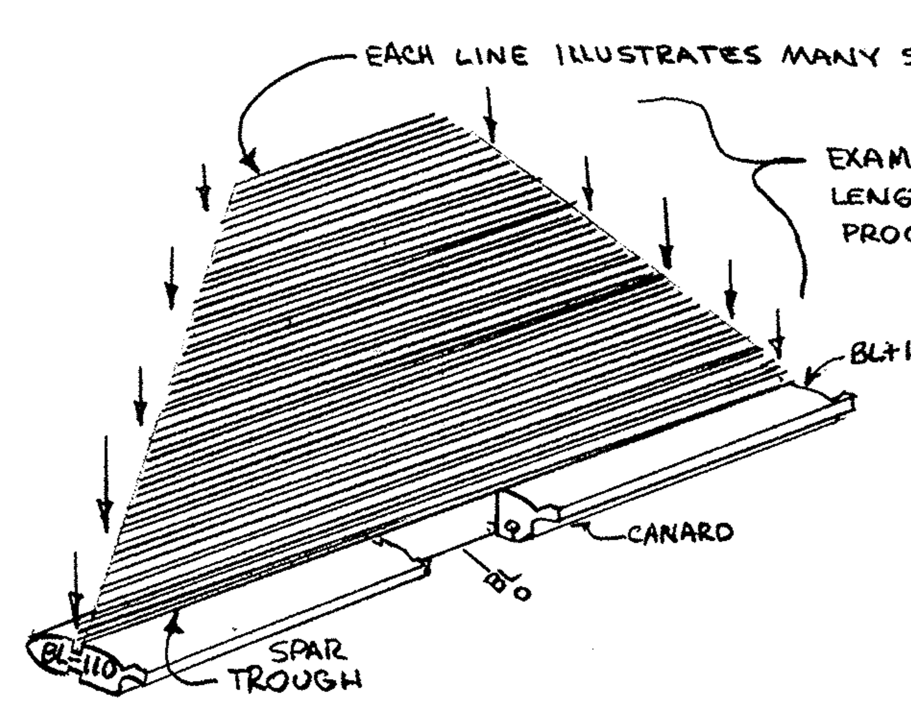
② (2ND PLY) 1 UND @ OPPOSITE 45° FULL LENGTH (PEEL PLY ENTIRE SURFACE)

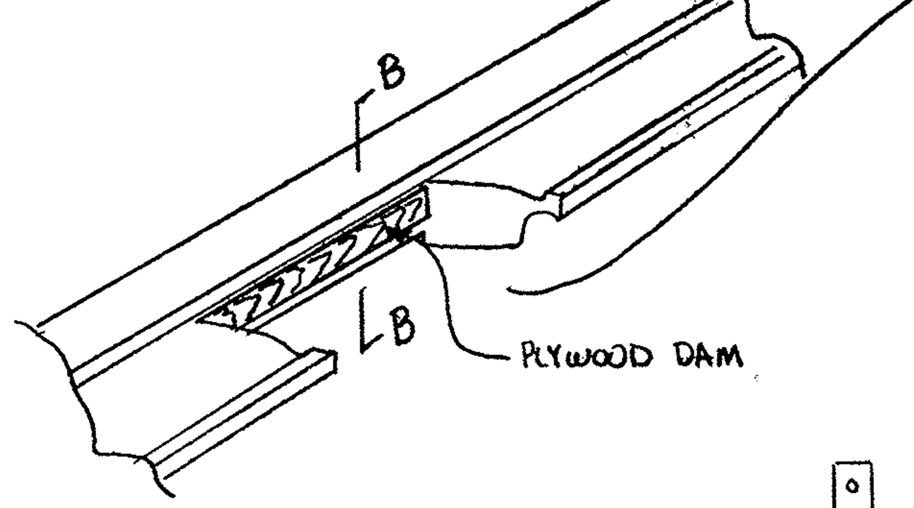
② (1ST PLY) 1 UND @ 45° FULL LENGTH

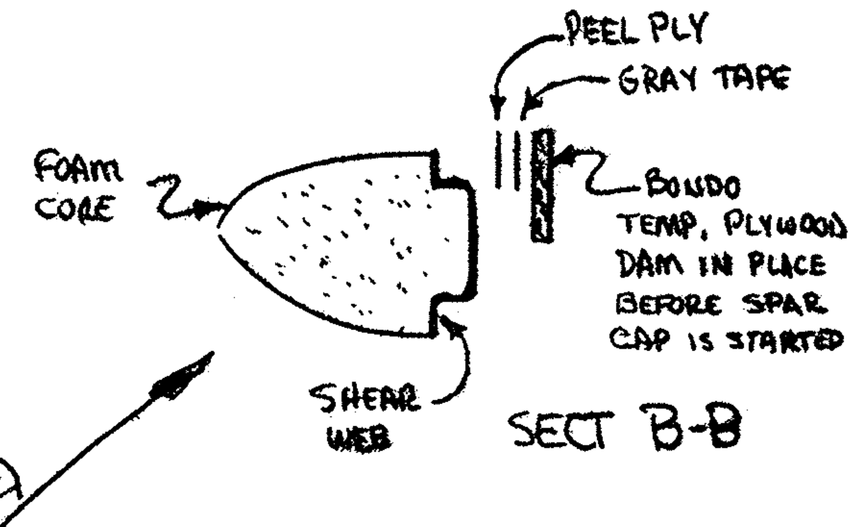
② (2ND PLY) 1 UND @ OPPOSITE 45° FULL LENGTH (PEEL PLY ENTIRE SURFACE)



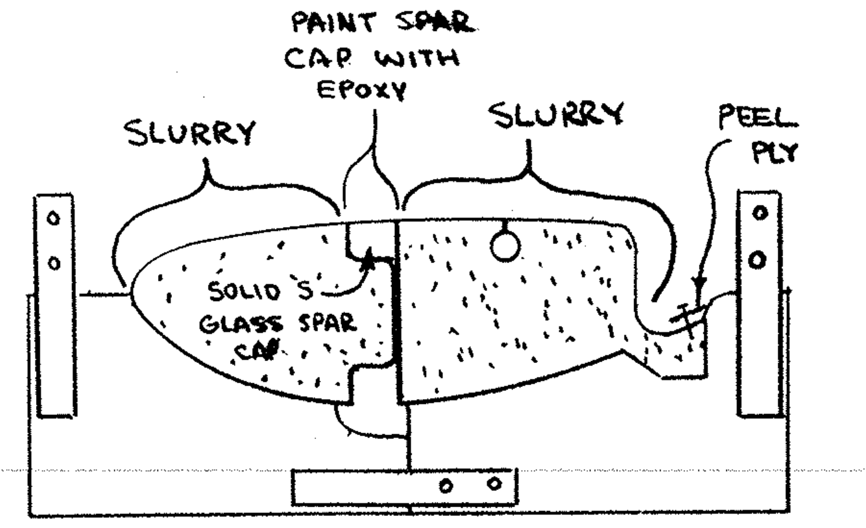
BONDO JIGS TO TABLE & TOGETHER





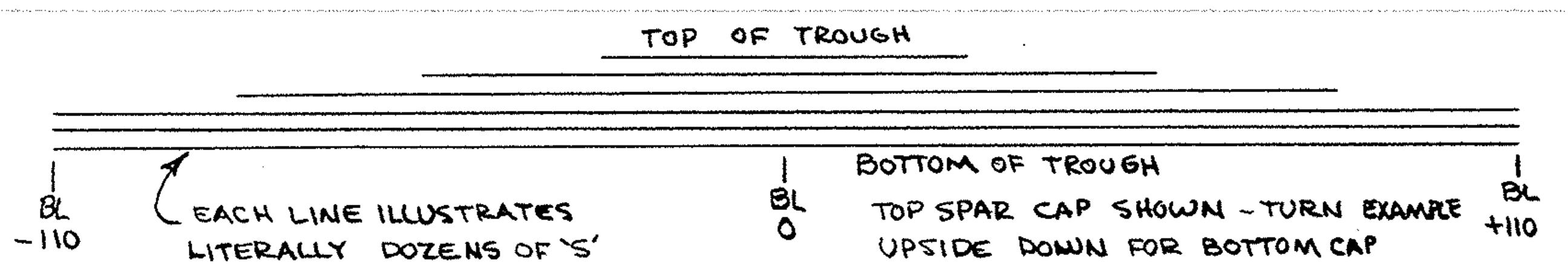


SECT B-B



USE JIGS IN DIFFERENT COMBINATIONS TO RIG FOAM CORES INTO ALL REQUIRED POSITIONS. ALL SIDES OF JIG ARE LEVEL OR SQUARE TO WL-49.

TYPICAL CANARD SPAR CAP (TOP OR BOTTOM)

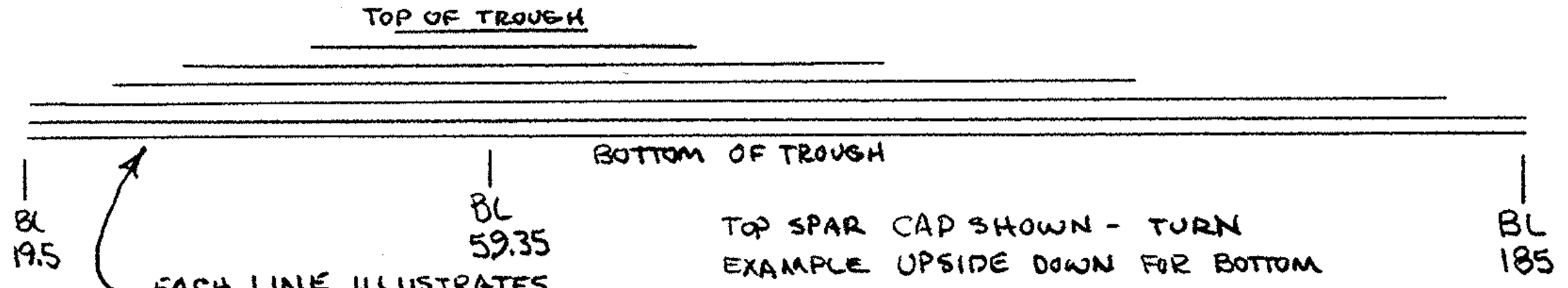


EACH LINE ILLUSTRATES LITERALLY DOZENS OF 'S' GLASS STRANDS. 1ST STRANDS PLACED ARE THE LONGEST

TOP SPAR CAP SHOWN – TURN EXAMPLE UPSIDE DOWN FOR BOTTOM CAP

PEEL PLY SPAR CAP AFTER COMPLETION

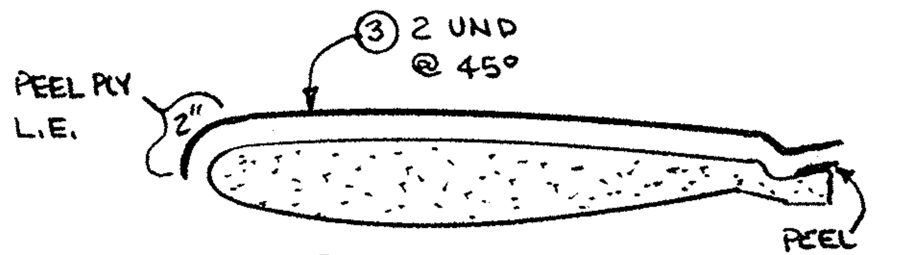
TYPICAL MAIN WING SPAR CAP (TOP OR BOTTOM)



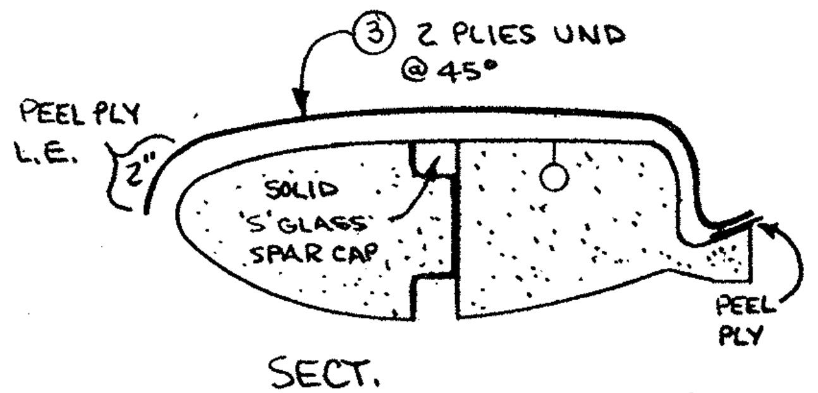
EACH LINE ILLUSTRATES LITERALLY DOZENS OF 'S' GLASS STRANDS. 1ST STRANDS PLACED ARE THE LONGEST

TOP SPAR CAP SHOWN – TURN EXAMPLE UPSIDE DOWN FOR BOTTOM CAP

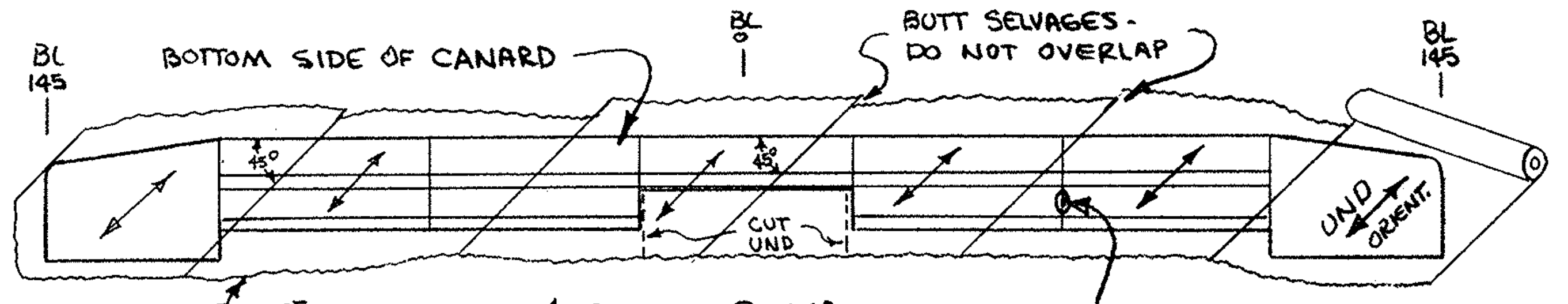
(SLURRY ALL FOAM)
(BEFORE GLASSING)



SECT. OUTBOARD CORE (UPSIDE DOWN) 'NO SPAR CAPS'

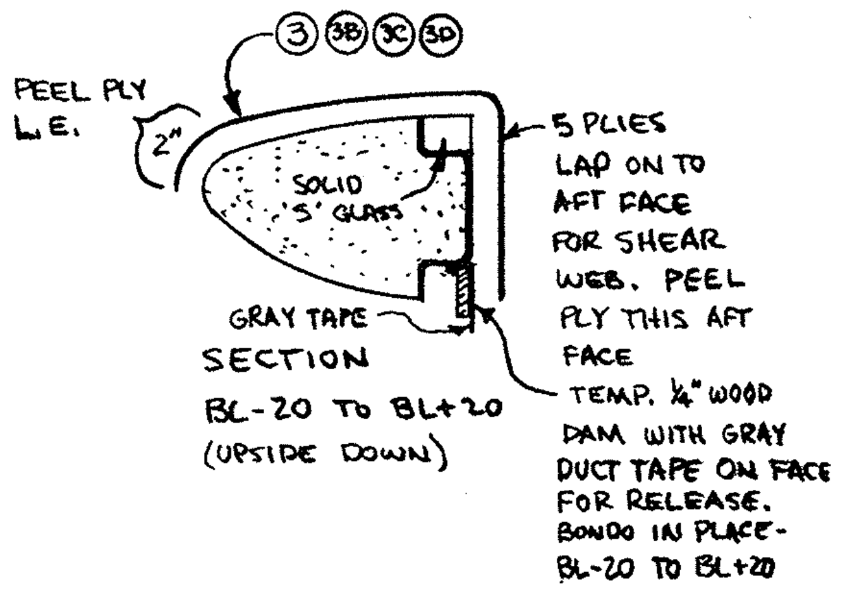


SECT. (CANARD UP SIDE DOWN).

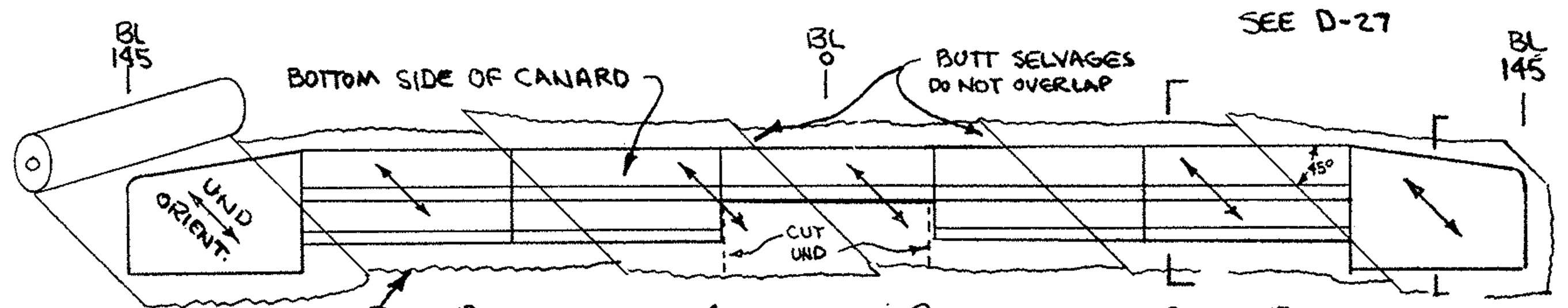


③ 1ST BOTTOM PLY – 1 PLY UND @ 45° FULL SPAN

INSTALL PITOT BASE C-30 BEFORE LAYUP ③ SEE D-27

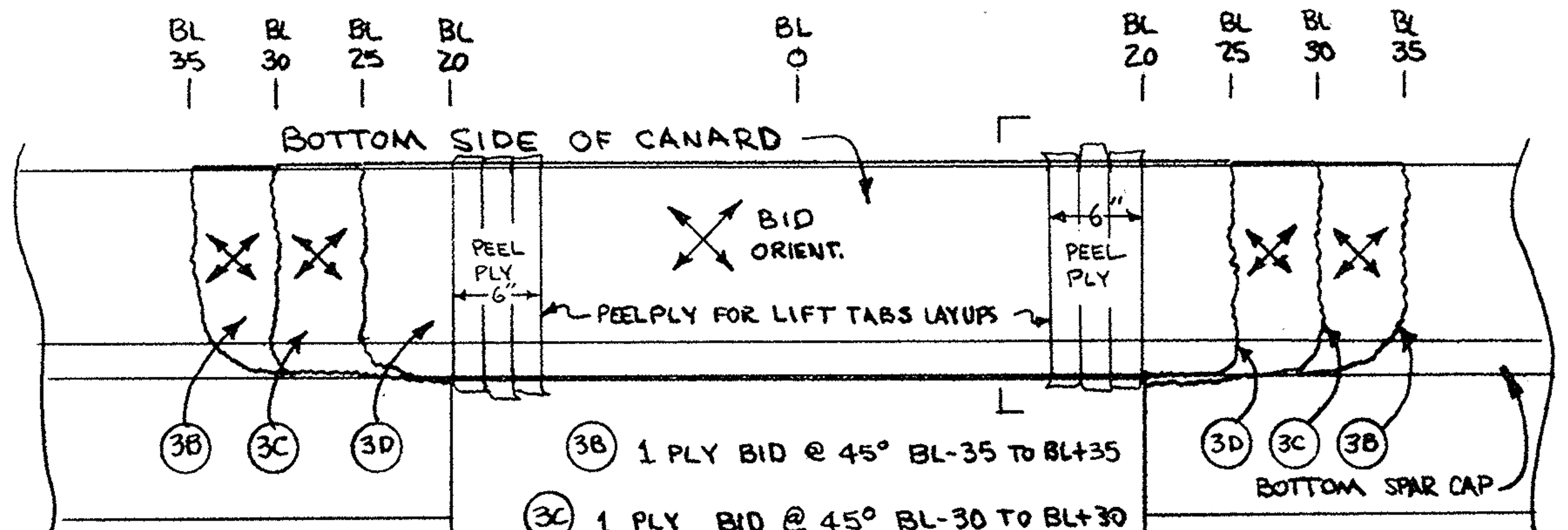


SECTION BL-20 TO BL+20 (UPSIDE DOWN)



③ 2ND BOTTOM PLY – 1 PLY UND @ OPPOSITE 45° TO 1ST PLY FULL SPAN

BOTH PLIES UND ③ LAP ON TO FULL AFT FACE OF CENTER SECTION BL-20 TO BL+20 TO FORM CENTER SHEAR WEB



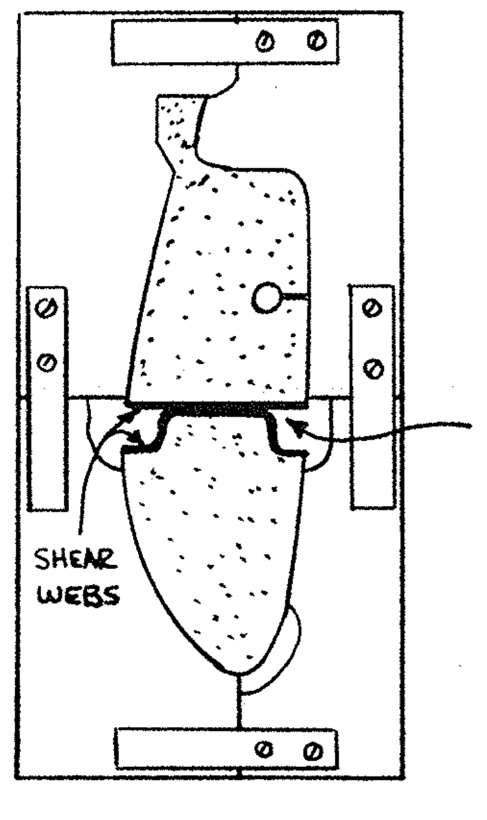
③B 1 PLY BID @ 45° BL-35 TO BL+35

③C 1 PLY BID @ 45° BL-30 TO BL+30

③D 1 PLY BID @ 45° BL-25 TO BL+25

ALL 3 PLIES BID LAP ON TO FULL AFT FACE OF CENTER SECTION, IN ADDITION TO SKIN UND ③, BL-20 TO BL+20 TO FORM CENTER SHEAR WEB.

(THERE IS NO ③A PLY)

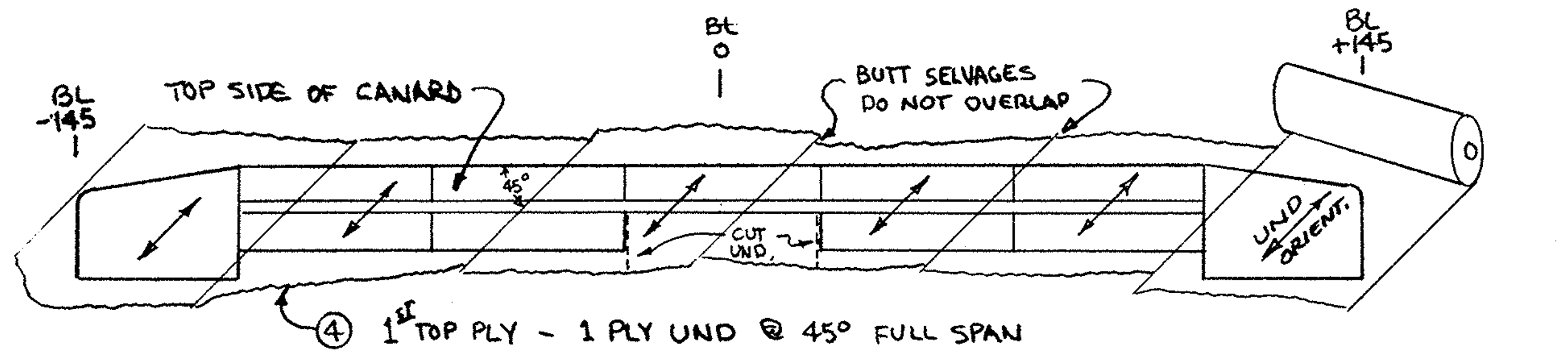


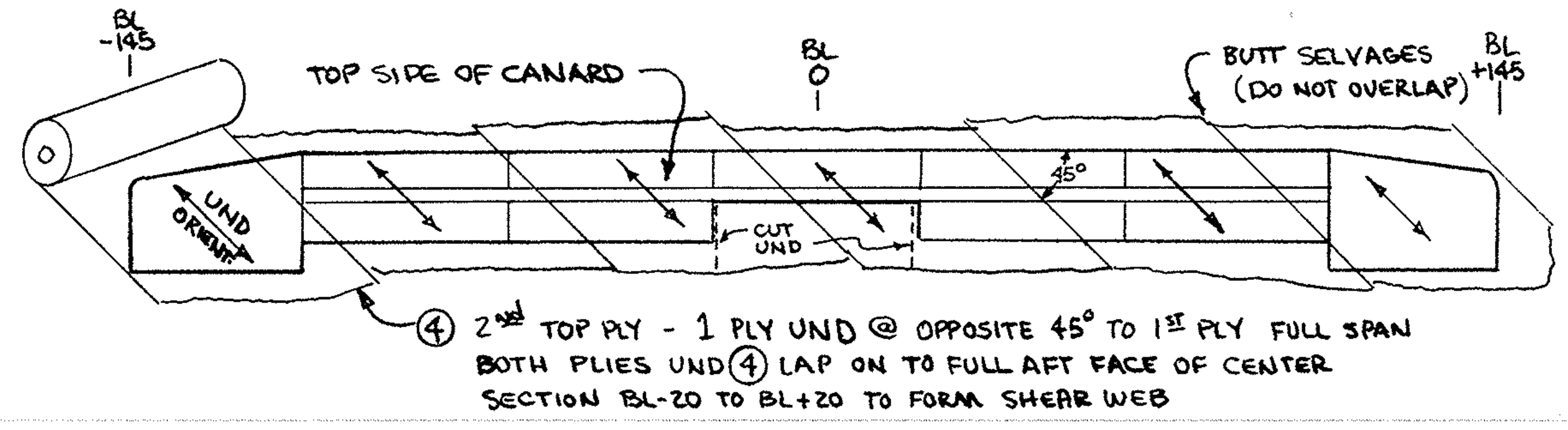
REMOVE PEELPLY FROM BOTH FACES AND TROWEL A ½" HIGH RIDGE OF MICRO ALONG FULL LENGTH AND INSTALL AFT PORTION IN PLACE AS SHOWN. LET CURE

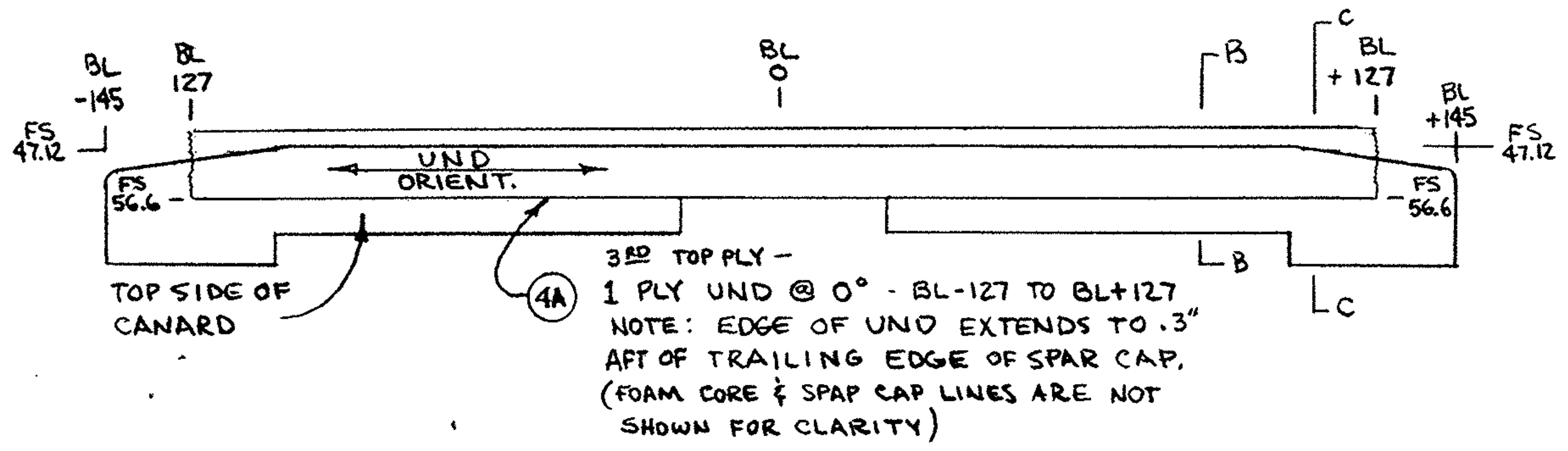
(SLURRY ALL FOAM)

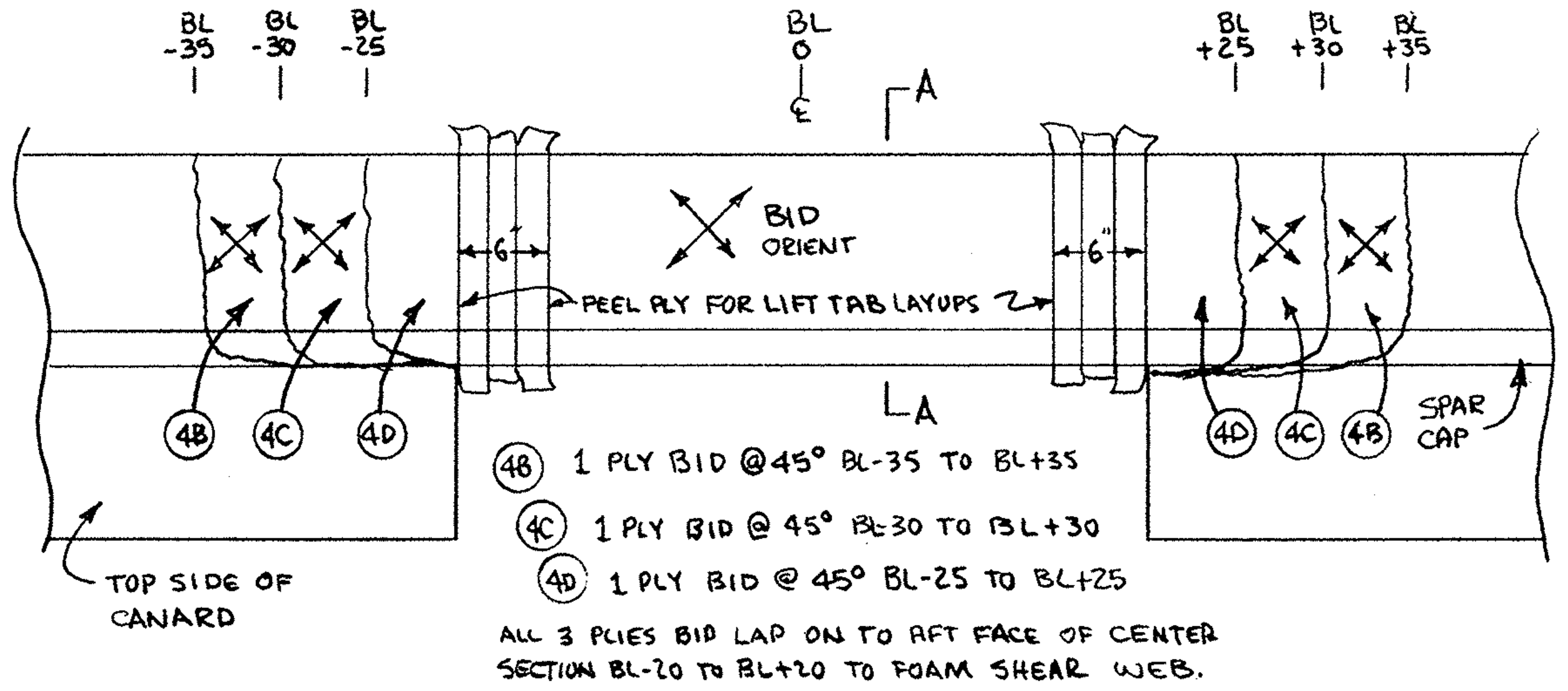
SEE PHOTO'S PAGE C-3 & D-20 FOR FOAM CORES

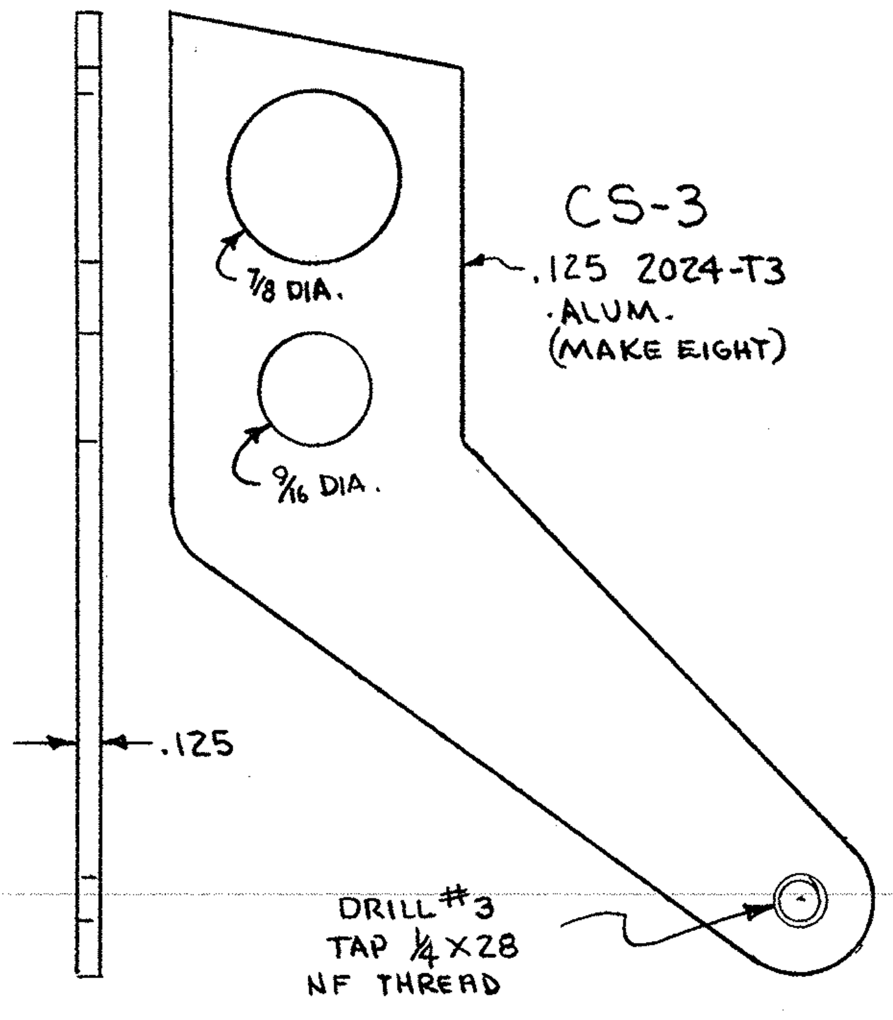
SEE SECT. A-A BEFORE DOING LAYUP ④

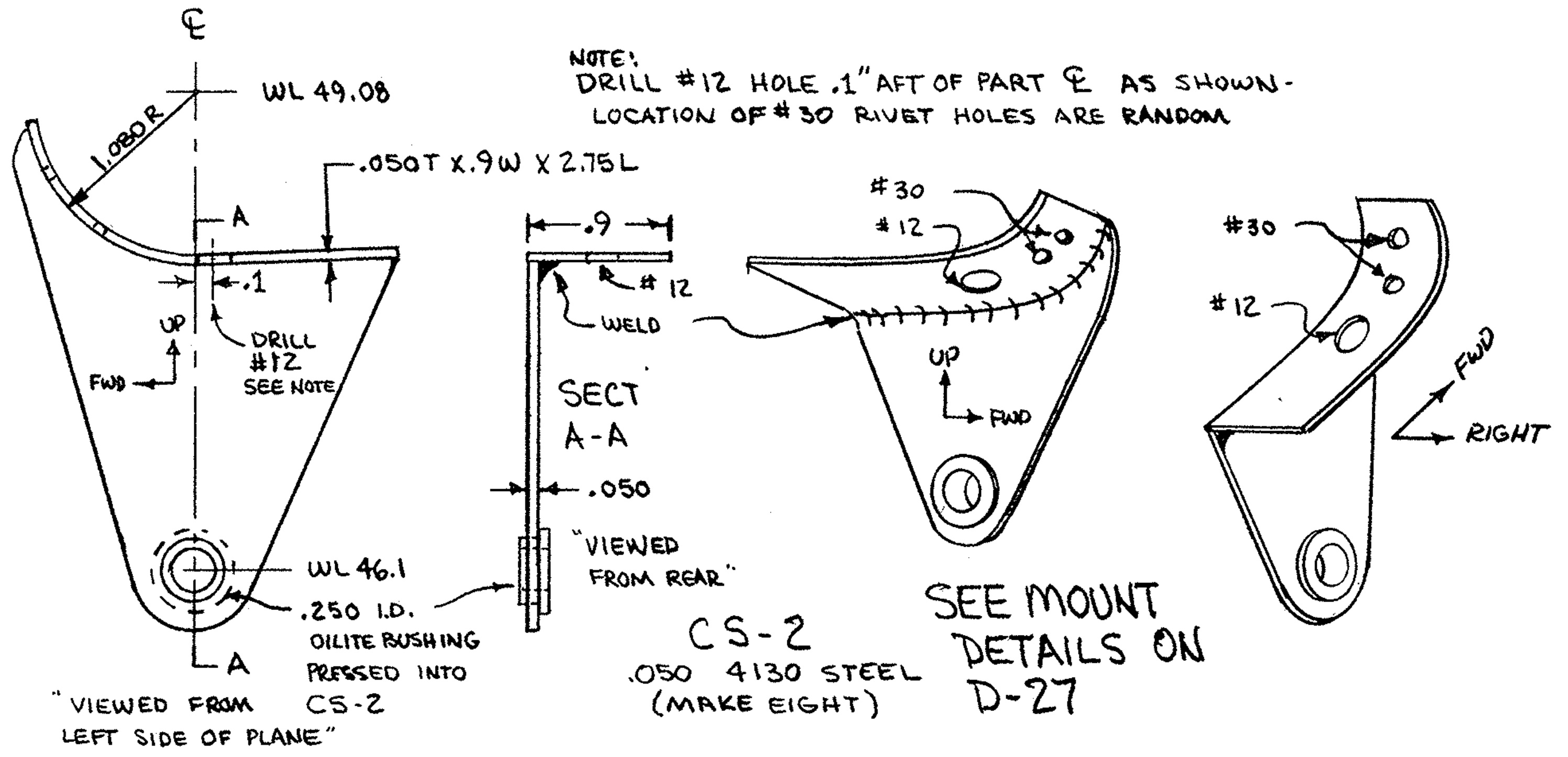

BL -145
TOP SIDE OF CANARD
BL 0
BUTT SELVAGES DO NOT OVERLAP
BL +145
45°
CUT UND.
UND ORIENT.
④ 1ST TOP PLY - 1 PLY UND @ 45° FULL SPAN

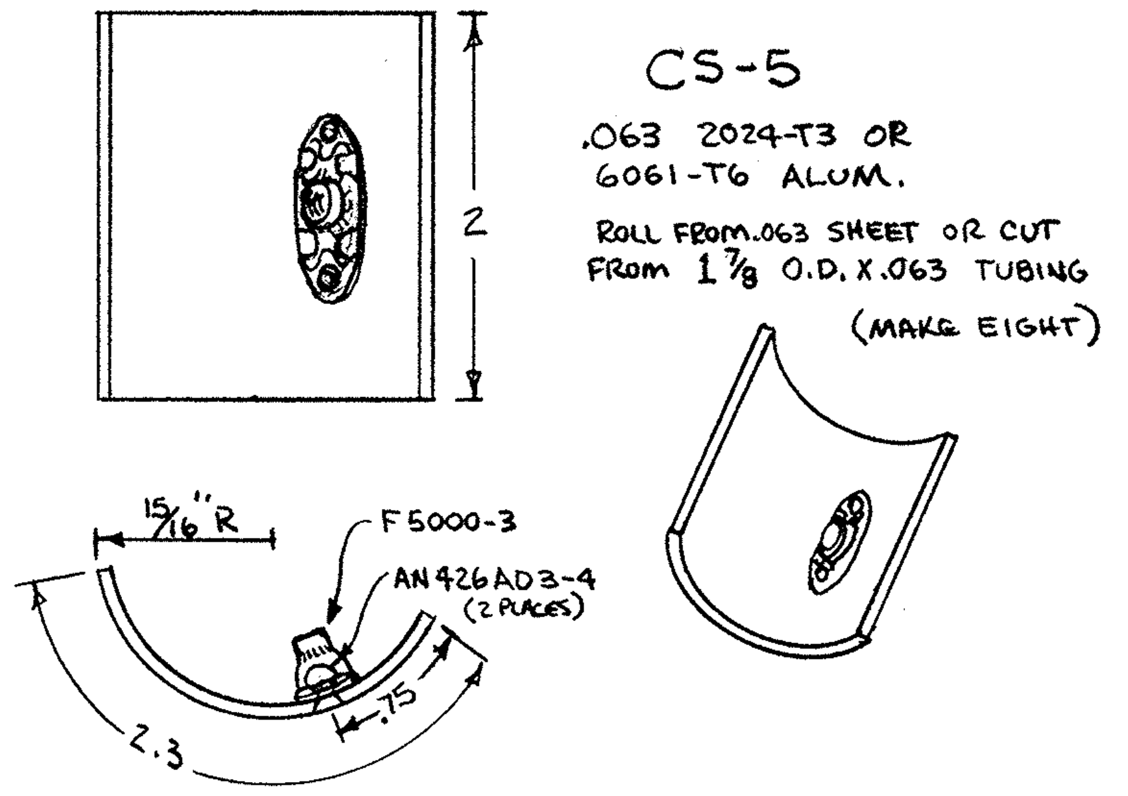

BL -145
TOP SIDE OF CANARD
BL 0
BUTT SELVAGES (DO NOT OVERLAP)
BL +145
UND ORIENT.
45°
CUT UND
④ 2ND TOP PLY - 1 PLY UND @ OPPOSITE 45° TO 1ST PLY FULL SPAN
BOTH PLIES UND ④ LAP ON TO FULL AFT FACE OF CENTER SECTION BL-20 TO BL+20 TO FORM SHEAR WEB

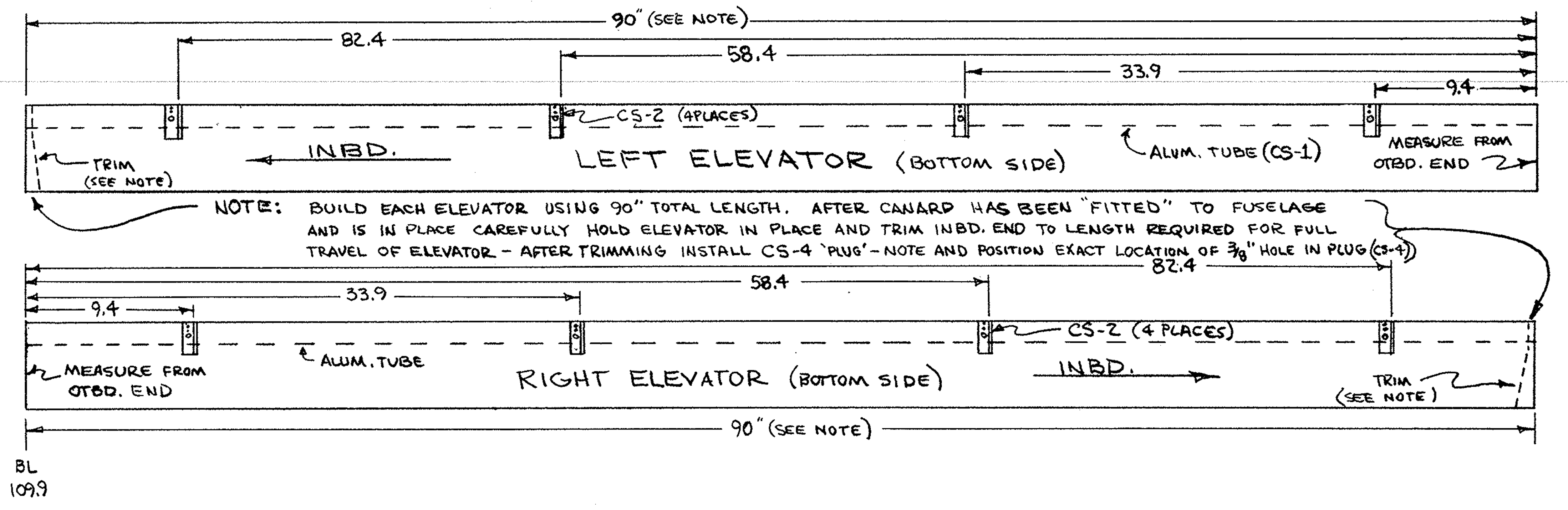

BL -145
BL 127
BL 0
B
C
BL +127
BL +145
FS 47.12
FS 56.6
UND ORIENT.
FS 47.12
FS 56.6
B
C
TOP SIDE OF CANARD
3RD TOP PLY -
(4A) 1 PLY UND @ 0° - BL-127 TO BL+127
NOTE: EDGE OF UND EXTENDS TO .3" AFT OF TRAILING EDGE OF SPAR CAP.
(FOAM CORE & SPAP CAP LINES ARE NOT SHOWN FOR CLARITY)

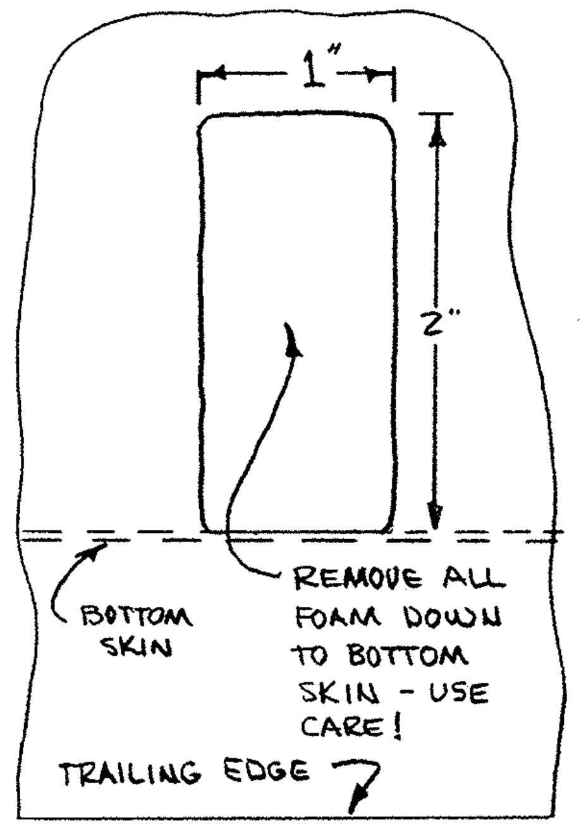

BL -35
BL -30
BL -25
BL 0
A
BL +25
BL +30
BL +35
BID ORIENT
6"
6"
PEEL PLY FOR LIFT TAB LAYUPS
A
(4B)
(4C)
(4D)
(4D)
(4C)
(4B)
SPAR CAP
TOP SIDE OF CANARD
(4B) 1 PLY BID @ 45° BL-35 TO BL+35
(4C) 1 PLY BID @ 45° BL-30 TO BL+30
(4D) 1 PLY BID @ 45° BL-25 TO BL+25
ALL 3 PLIES BID LAP ON TO AFT FACE OF CENTER SECTION BL-20 TO BL+20 TO FOAM SHEAR WEB.

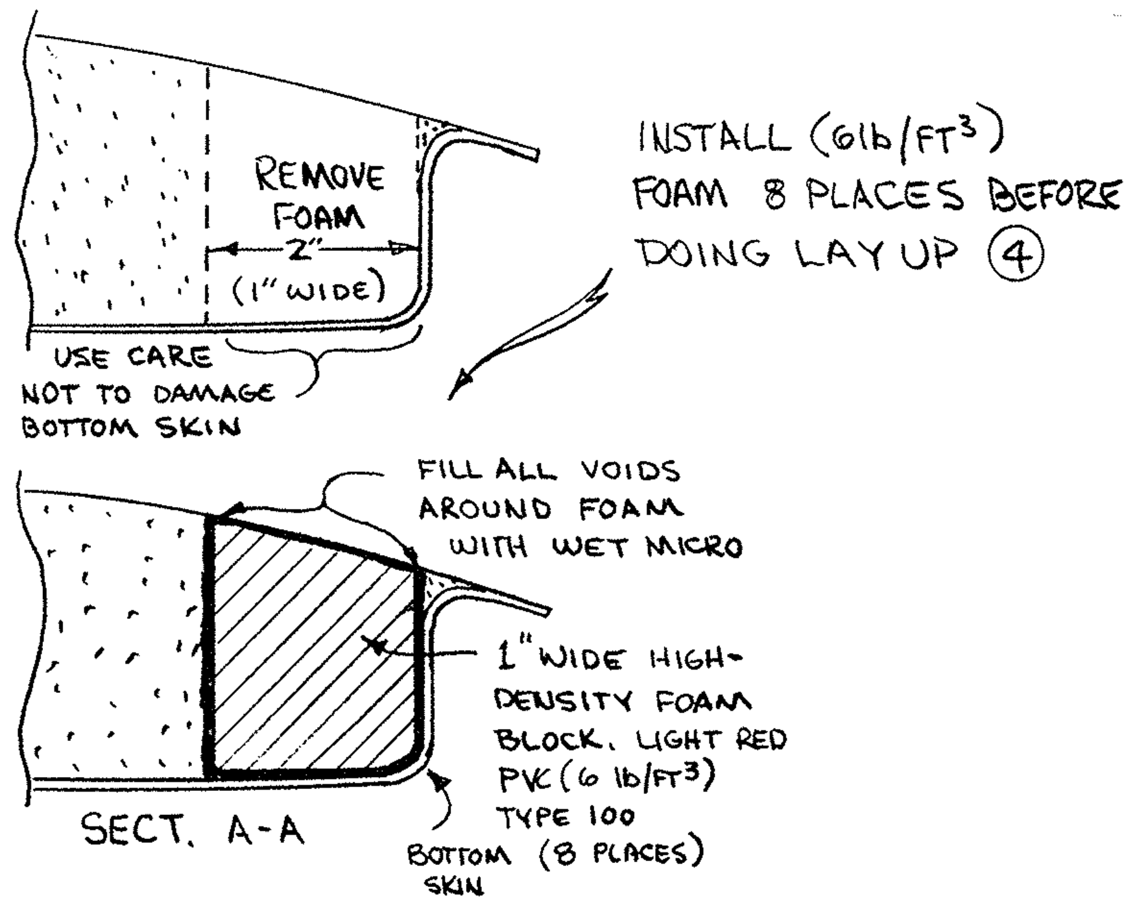


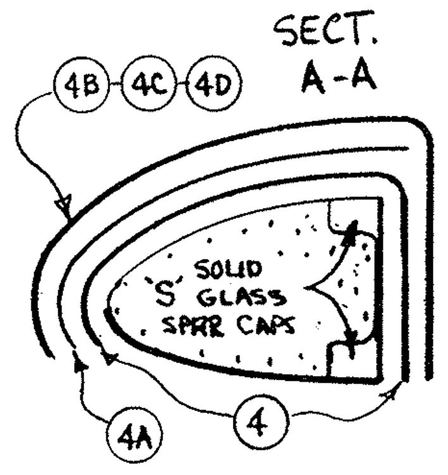

NOTE:
DRILL #12 HOLE .1" AFT OF PART ℄ AS SHOWN - LOCATION OF #30 RIVET HOLES ARE RANDOM
℄
WL 49.08
1.080 R
.050 T X .9 W X 2.75 L
A
.1
UP
FWD
DRILL #12 SEE NOTE
WL 46.1
.250 I.D. OILITE BUSHING PRESSED INTO CS-2
A
"VIEWED FROM LEFT SIDE OF PLANE"
.9
#12
WELD
SECT A-A
.050
"VIEWED FROM REAR"
CS-2
.050 4130 STEEL
(MAKE EIGHT)
#30
#12
UP
FWD
SEE MOUNT DETAILS ON D-27
#30
#12
FWD
RIGHT

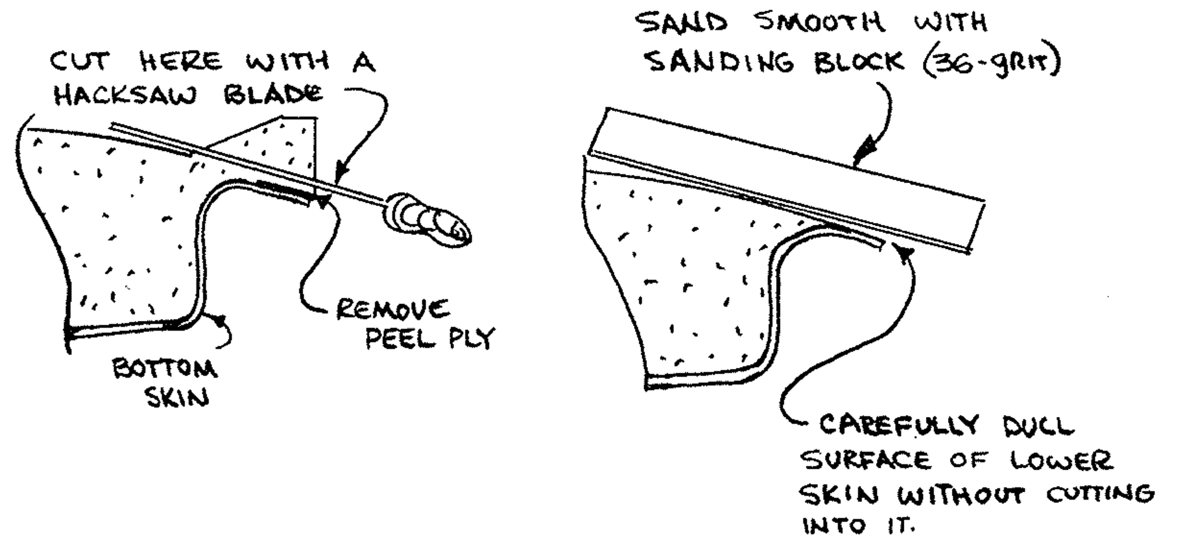

2
CS-5
.063 2024-T3 OR 6061-T6 ALUM.
ROLL FROM .063 SHEET OR CUT FROM 1 7/8 O.D. X .063 TUBING
(MAKE EIGHT)
15/16" R
F5000-3
AN426AD3-4 (2 PLACES)
2.3
.75

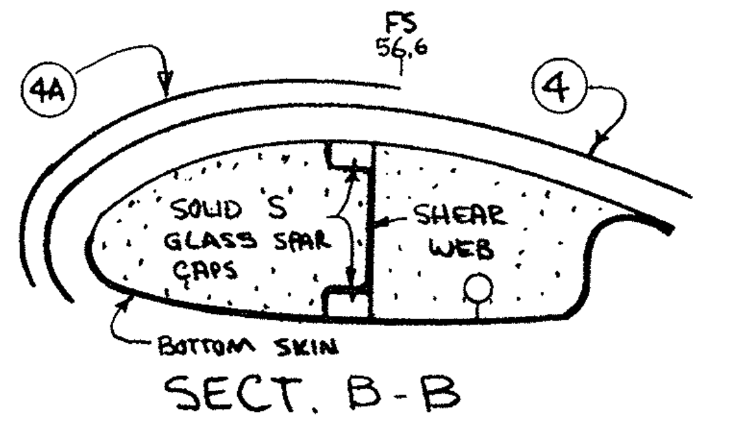

BL 109.9
90" (SEE NOTE)
82.4
58.4
33.9
9.4
CS-2 (4PLACES)
INBD.
LEFT ELEVATOR (BOTTOM SIDE)
ALUM. TUBE (CS-1)
MEASURE FROM OTBD. END
TRIM (SEE NOTE)
NOTE: BUILD EACH ELEVATOR USING 90" TOTAL LENGTH. AFTER CANARD HAS BEEN "FITTED" TO FUSELAGE AND IS IN PLACE CAREFULLY HOLD ELEVATOR IN PLACE AND TRIM INBD. END TO LENGTH REQUIRED FOR FULL TRAVEL OF ELEVATOR - AFTER TRIMMING INSTALL CS-4 'PLUG' - NOTE AND POSITION EXACT LOCATION OF 3/8" HOLE IN PLUG (CS-4)
82.4
58.4
33.9
9.4
CS-2 (4 PLACES)
ALUM. TUBE
MEASURE FROM OTBD. END
RIGHT ELEVATOR (BOTTOM SIDE)
INBD.
TRIM (SEE NOTE)
90" (SEE NOTE)
BL 109.9

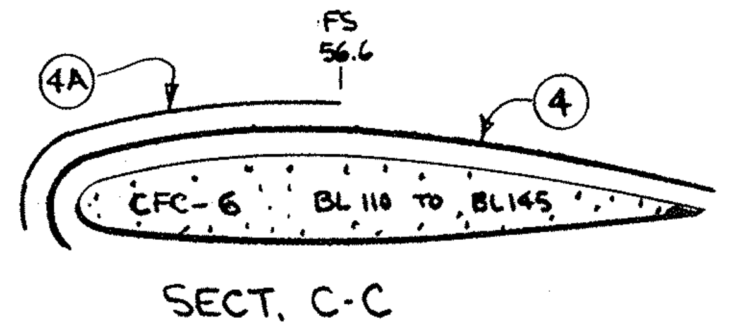


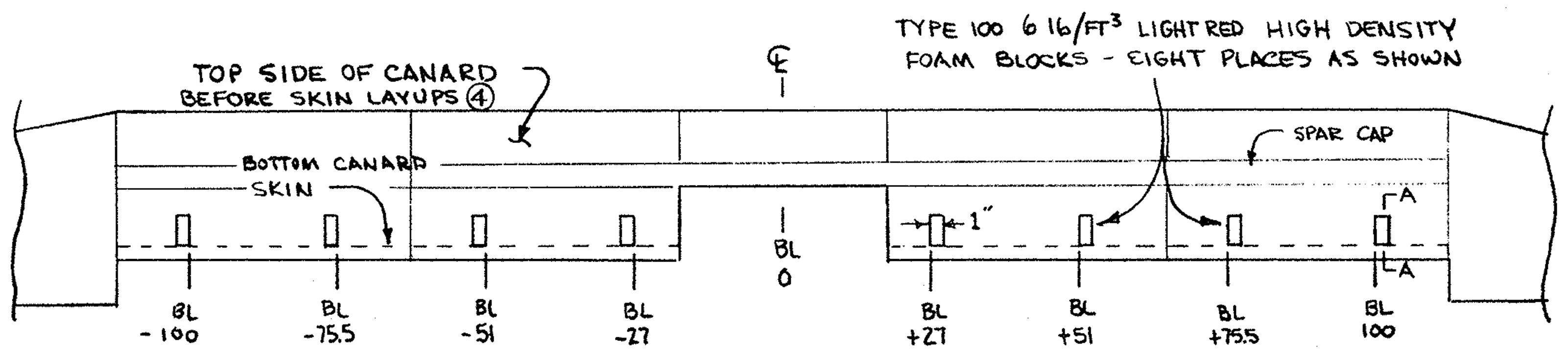

REMOVE FOAM
2"
(1" WIDE)
USE CARE NOT TO DAMAGE BOTTOM SKIN
INSTALL (6lb/FT³) FOAM 8 PLACES BEFORE DOING LAY UP ④
FILL ALL VOIDS AROUND FOAM WITH WET MICRO
1" WIDE HIGH-DENSITY FOAM BLOCK. LIGHT RED PVC (6 lb/FT³) TYPE 100
BOTTOM SKIN
(8 PLACES)
SECT. A-A

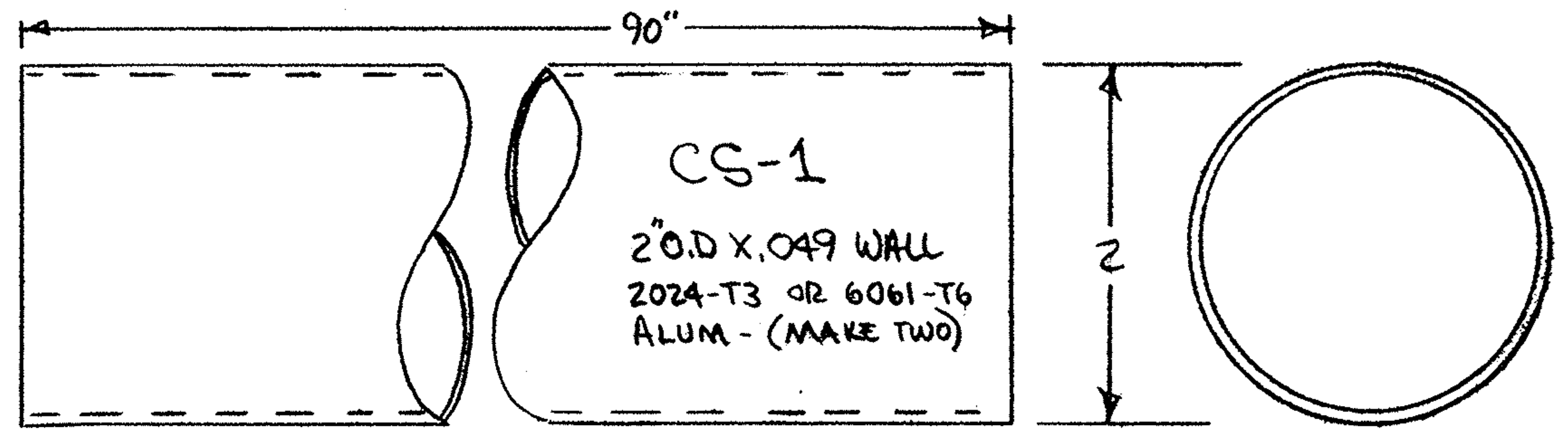


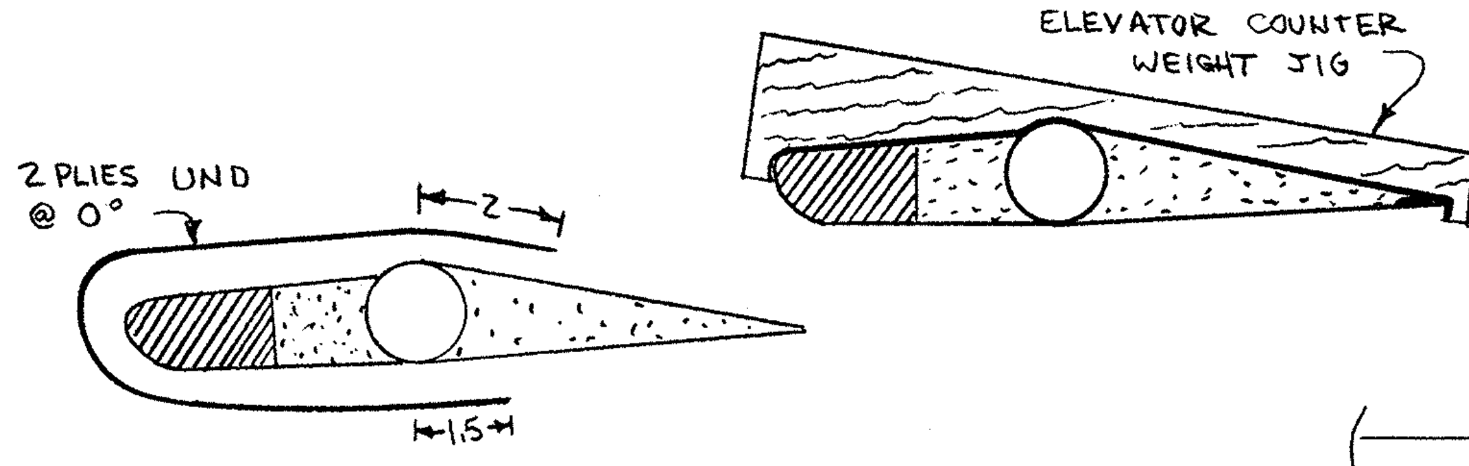

CUT HERE WITH A HACKSAW BLADE
REMOVE PEEL PLY
BOTTOM SKIN
SAND SMOOTH WITH SANDING BLOCK (36-grit)
CAREFULLY DULL SURFACE OF LOWER SKIN WITHOUT CUTTING INTO IT.

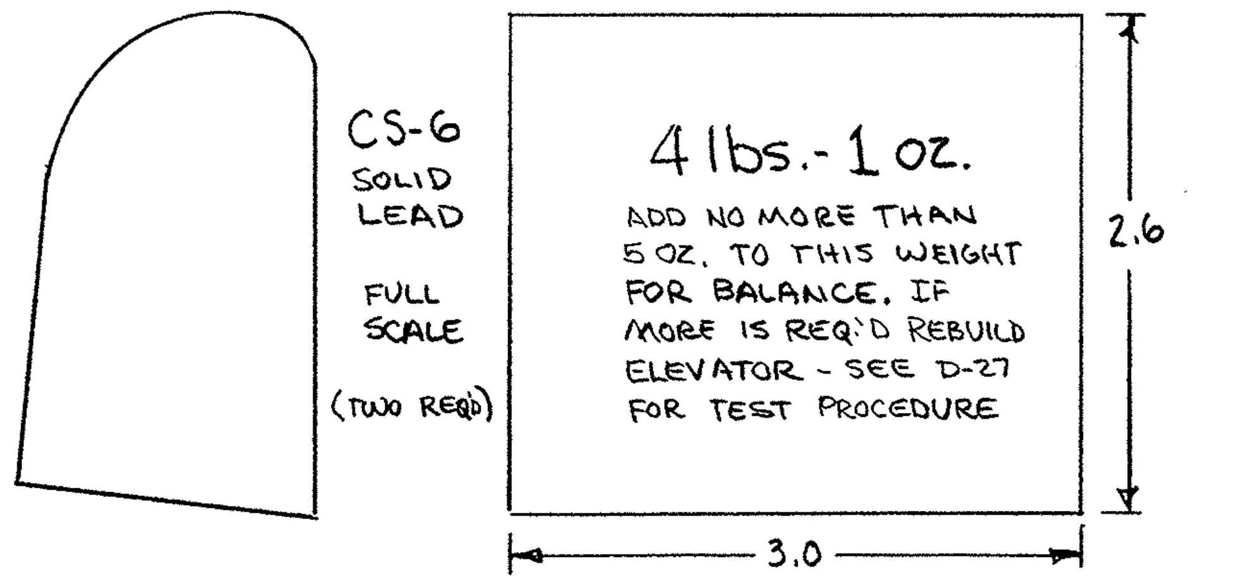


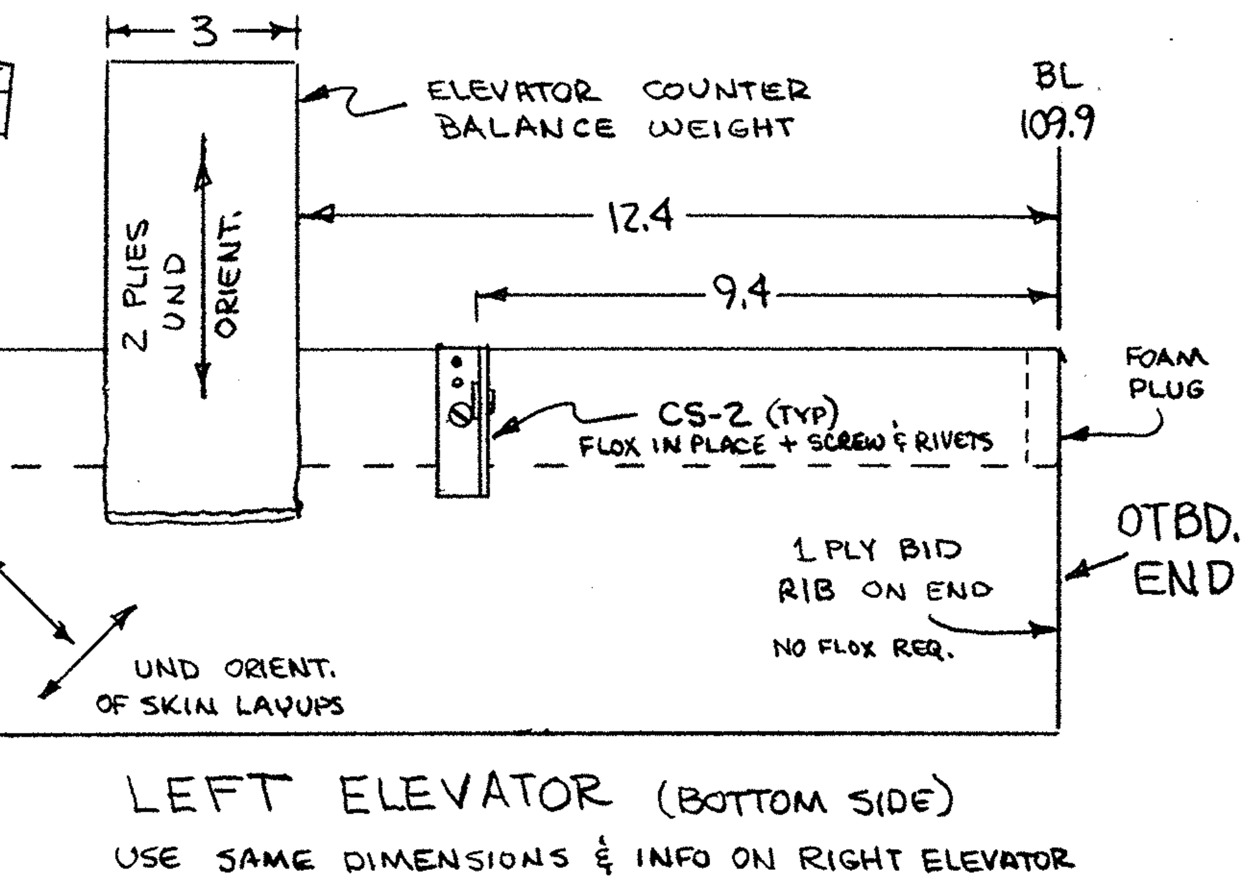


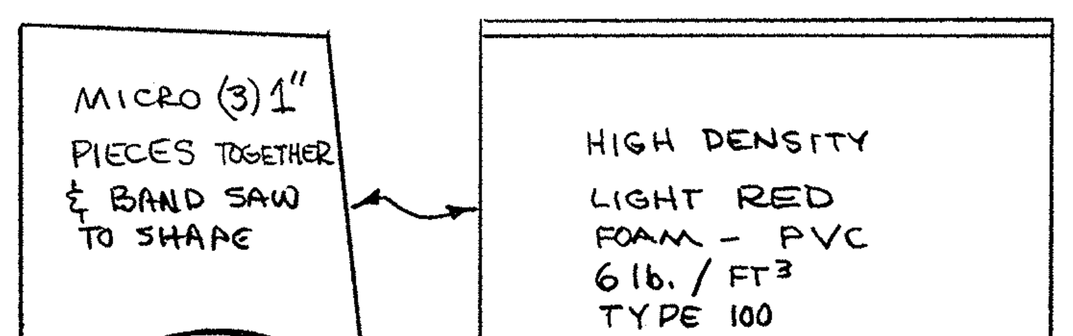

TYPE 100 6 lb/FT³ LIGHT RED HIGH DENSITY FOAM BLOCKS - EIGHT PLACES AS SHOWN
TOP SIDE OF CANARD BEFORE SKIN LAYUPS ④
℄
BOTTOM CANARD SKIN
SPAR CAP
1"
A
A
BL -100
BL -75.5
BL -51
BL -27
BL 0
BL +27
BL +51
BL +75.5
BL 100

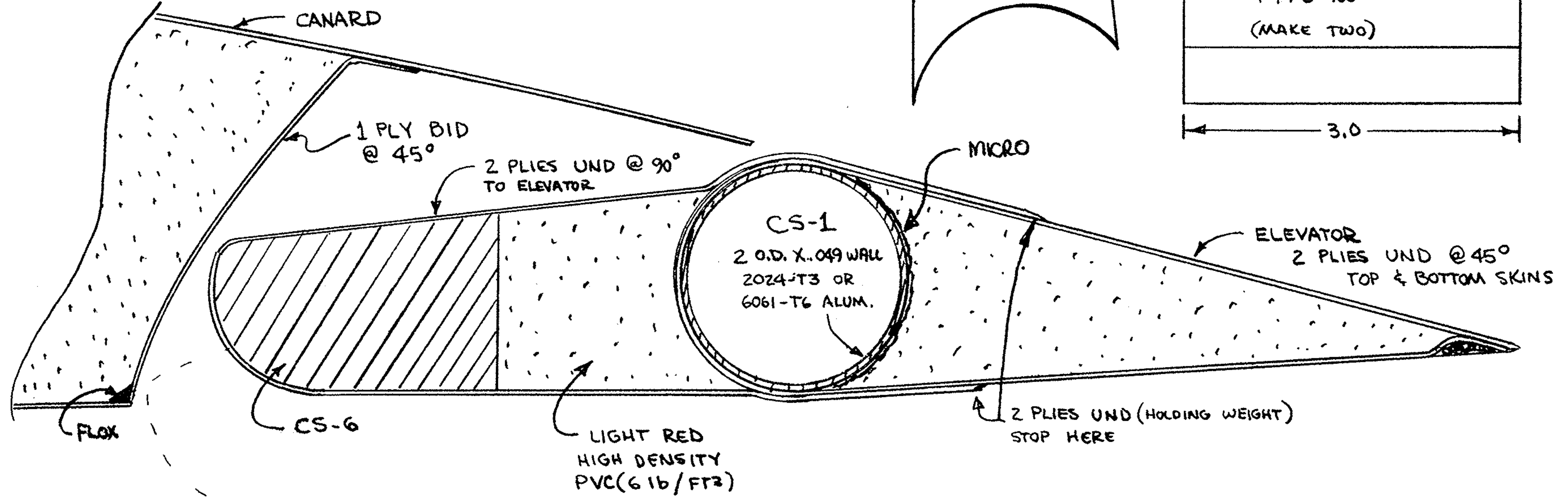




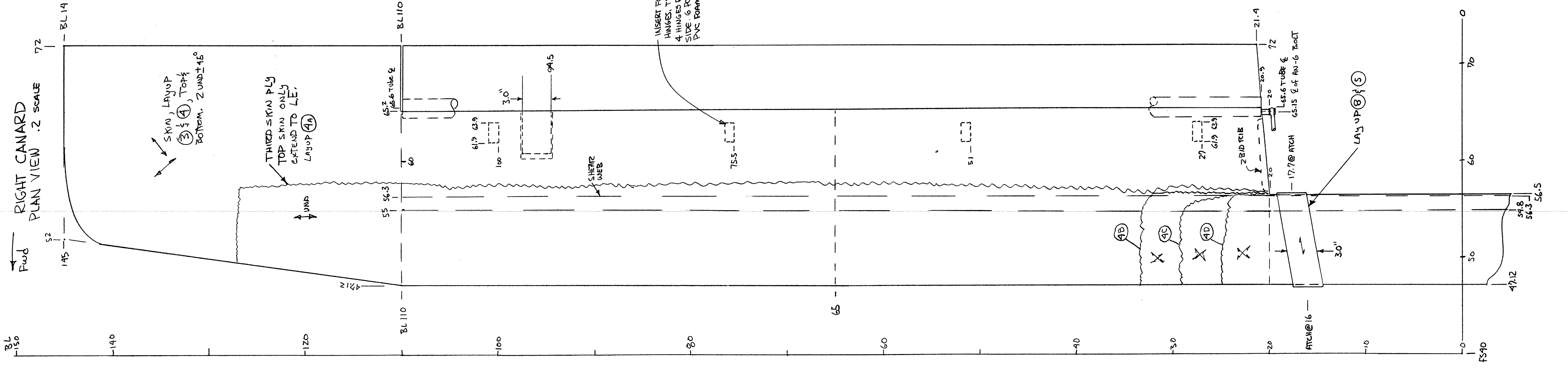

CS-6
SOLID LEAD
FULL SCALE
(TWO REQ'D)
4 lbs.-1 oz.
ADD NO MORE THAN 5 OZ. TO THIS WEIGHT FOR BALANCE. IF MORE IS REQ'D REBUILD ELEVATOR - SEE D-27 FOR TEST PROCEDURE
2.6
3.0

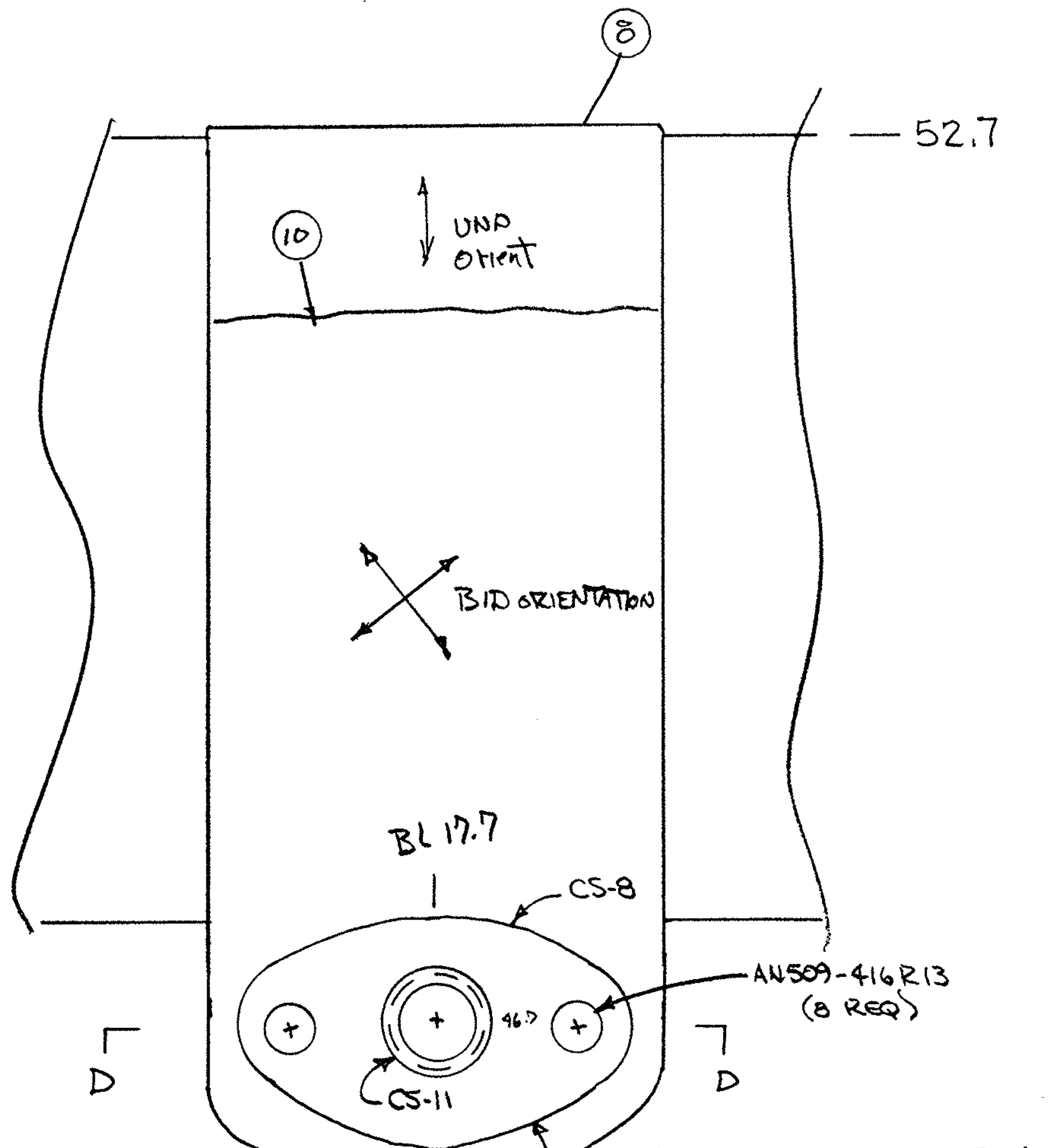

3
ELEVATOR COUNTER BALANCE WEIGHT
BL 109.9
2 PLIES UND ORIENT.
12.4
9.4
CS-2 (TYP)
FLOX IN PLACE + SCREW & RIVETS
FOAM PLUG
OTBD. END
1 PLY BID RIB ON END
NO FLOX REQ.
UND ORIENT. OF SKIN LAYUPS
LEFT ELEVATOR (BOTTOM SIDE)
USE SAME DIMENSIONS & INFO ON RIGHT ELEVATOR


MICRO (3) 1" PIECES TOGETHER & BAND SAW TO SHAPE
HIGH DENSITY LIGHT RED FOAM - PVC 6 lb. / FT³ TYPE 100 (MAKE TWO)
3.0

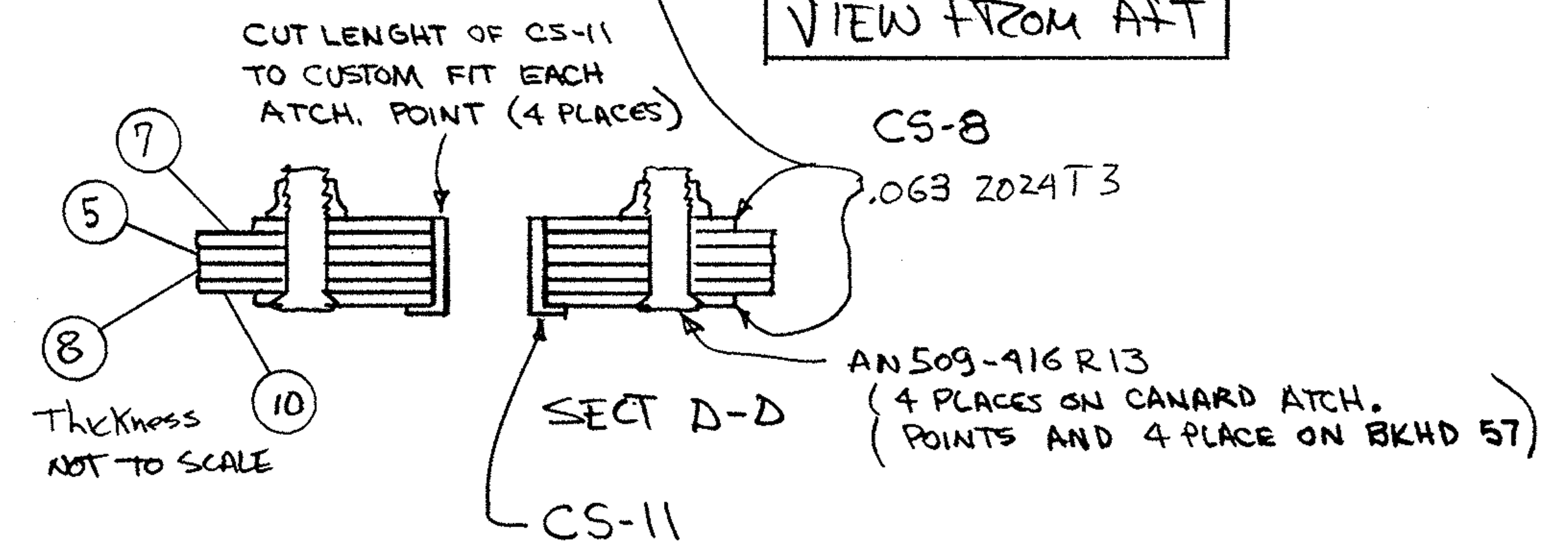


(SLURRY ALL FOAM)

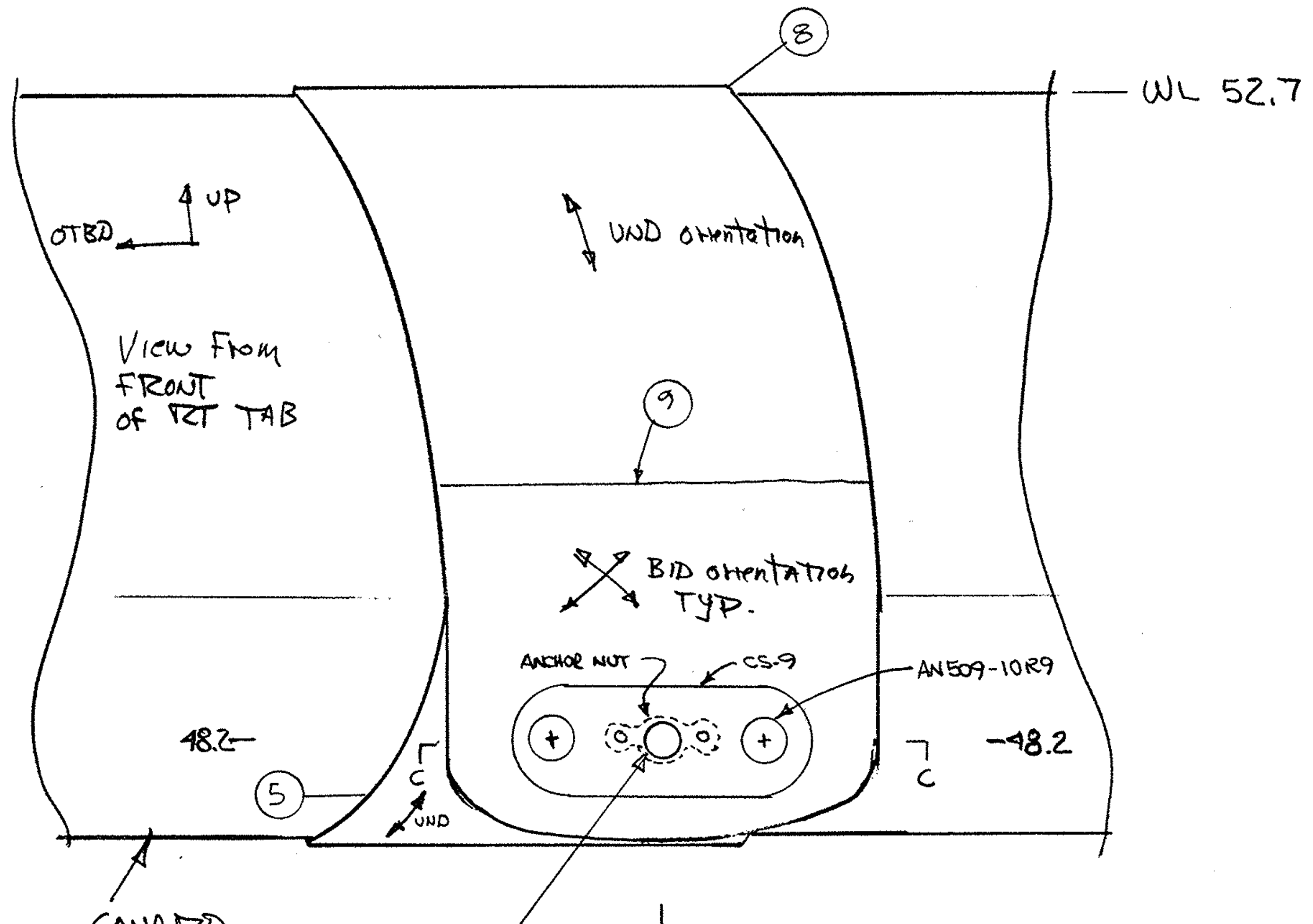




AFT LIFT TAB
VIEW FROM AFT

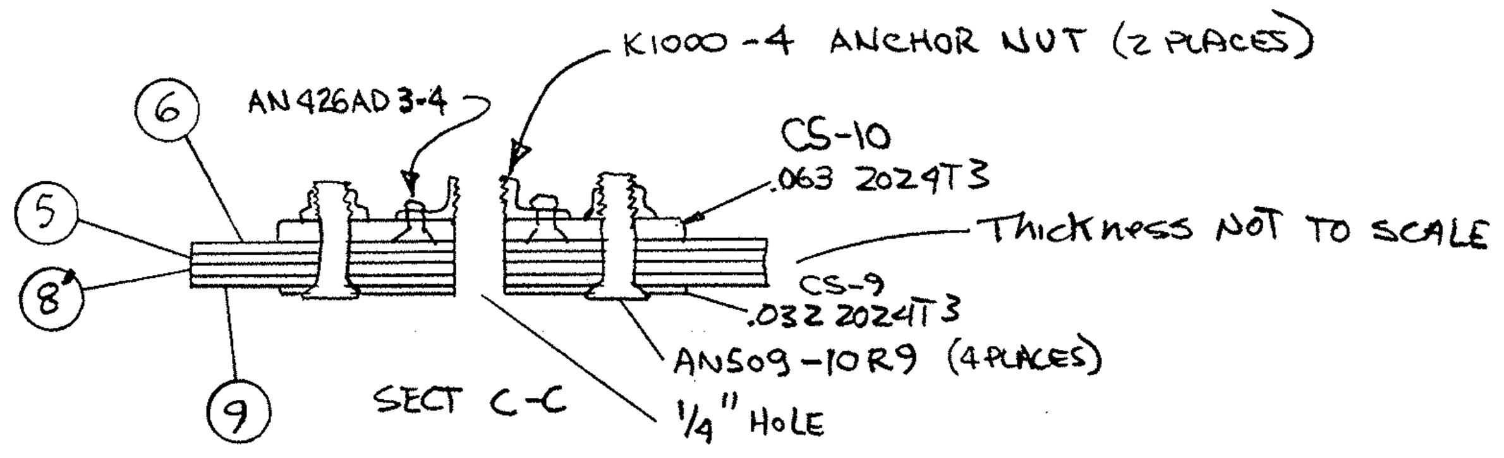

CUT LENGHT OF CS-11 TO CUSTOM FIT EACH ATCH. POINT (4 PLACES)
⑦
⑤
⑧
⑩
Thickness NOT TO SCALE
CS-8
.063 2024T3
AN509-416R13 (4 PLACES ON CANARD ATCH. POINTS AND 4 PLACE ON BKHD 57)
CS-11

SECT D-D



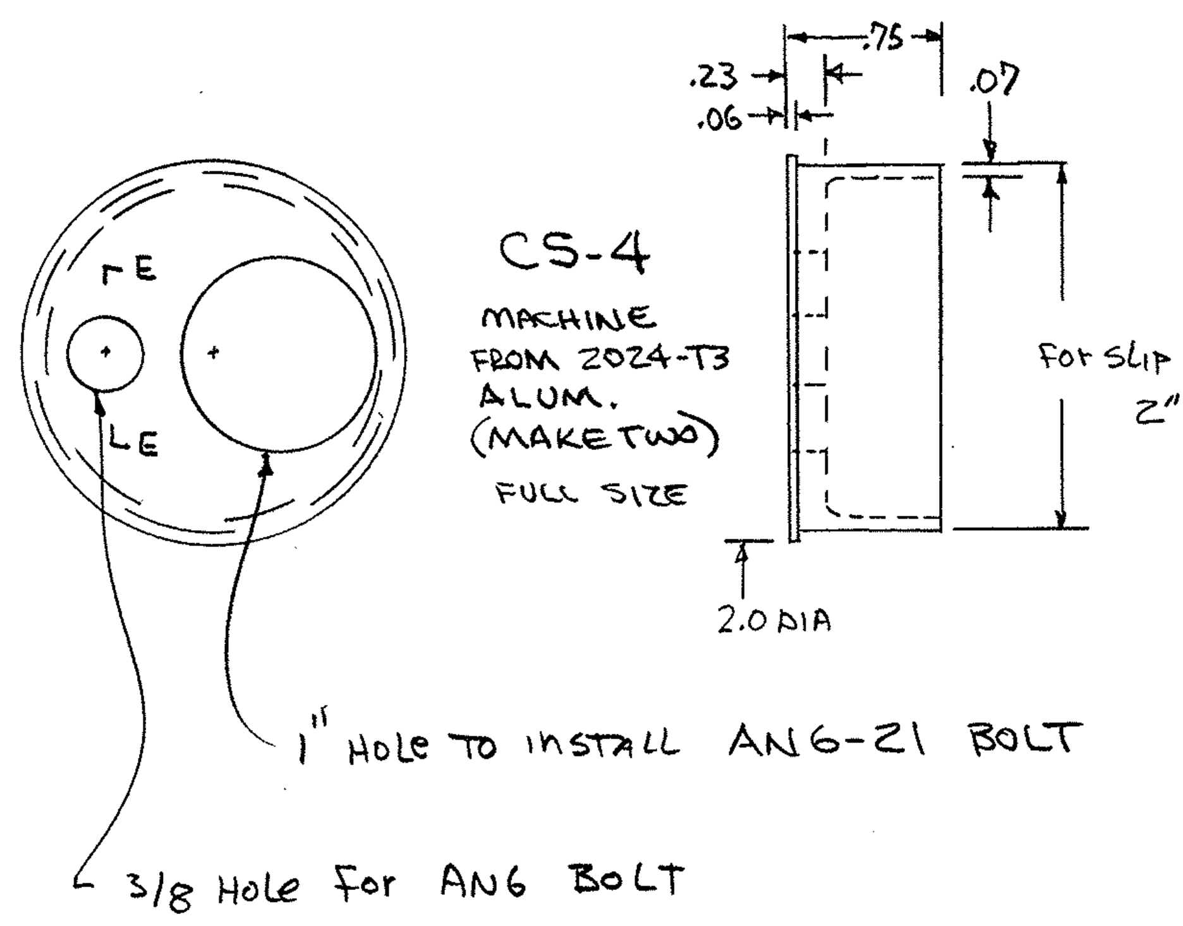
ATCH BOLT (AN4) GOES THRU FIREWALL TO ATCH HERE.

FORWARD LIFT TAB
(ATCH) DETAIL

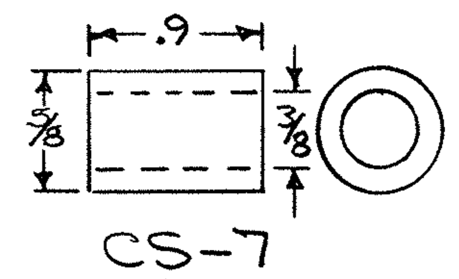


SECT C-C

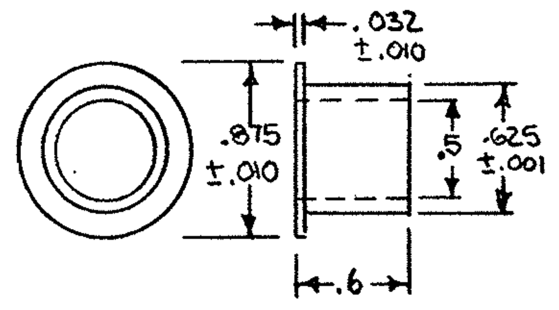
PLUG FOR END of ELEVATOR (INBD)
RIVET TO TUBE WITH 16 equal SPACED 1/8" AVEX RIVETS


TE
LE
.75
.23
.06
.07
For slip fit in your 2" X .049 TUBE
2.0 DIA
1" HOLE TO INSTALL AN6-21 BOLT
3/8 Hole For AN6 BOLT

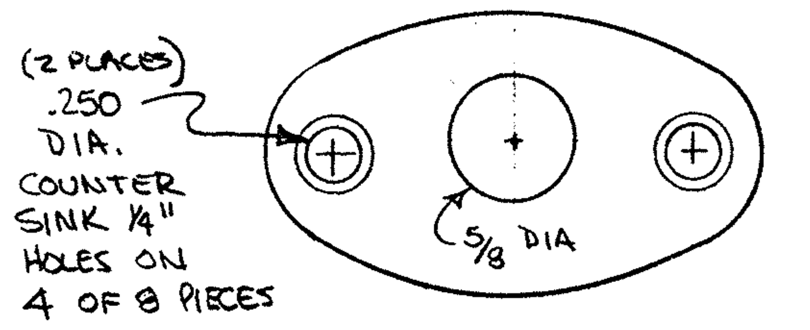
CS-4
MACHINE FROM 2024-T3 ALUM.
(MAKE TWO)
FULL SIZE



CS-7
2024-T3
(MAKE TWO)

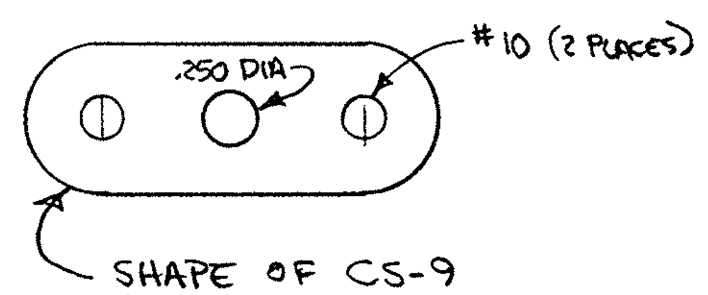


CS-11 2024-T3
ADJ. LENGHT TO FIT EACH ATCH. HOLE
(MAKE FOUR)
" ONE USED IN EACH LIFT TABS (CANARD) & ONE AT EACH ATCH POINT ON BKHD-57"


(2 PLACES) .250 DIA. COUNTER SINK 1/4" HOLES ON 4 OF 8 PIECES
5/8 DIA

CS-8
.063 2024-T3 ALUM.
MAKE EIGHT - COUNTER SINK 1/4" HOLES ON 4 EACH OF 8 TOTAL

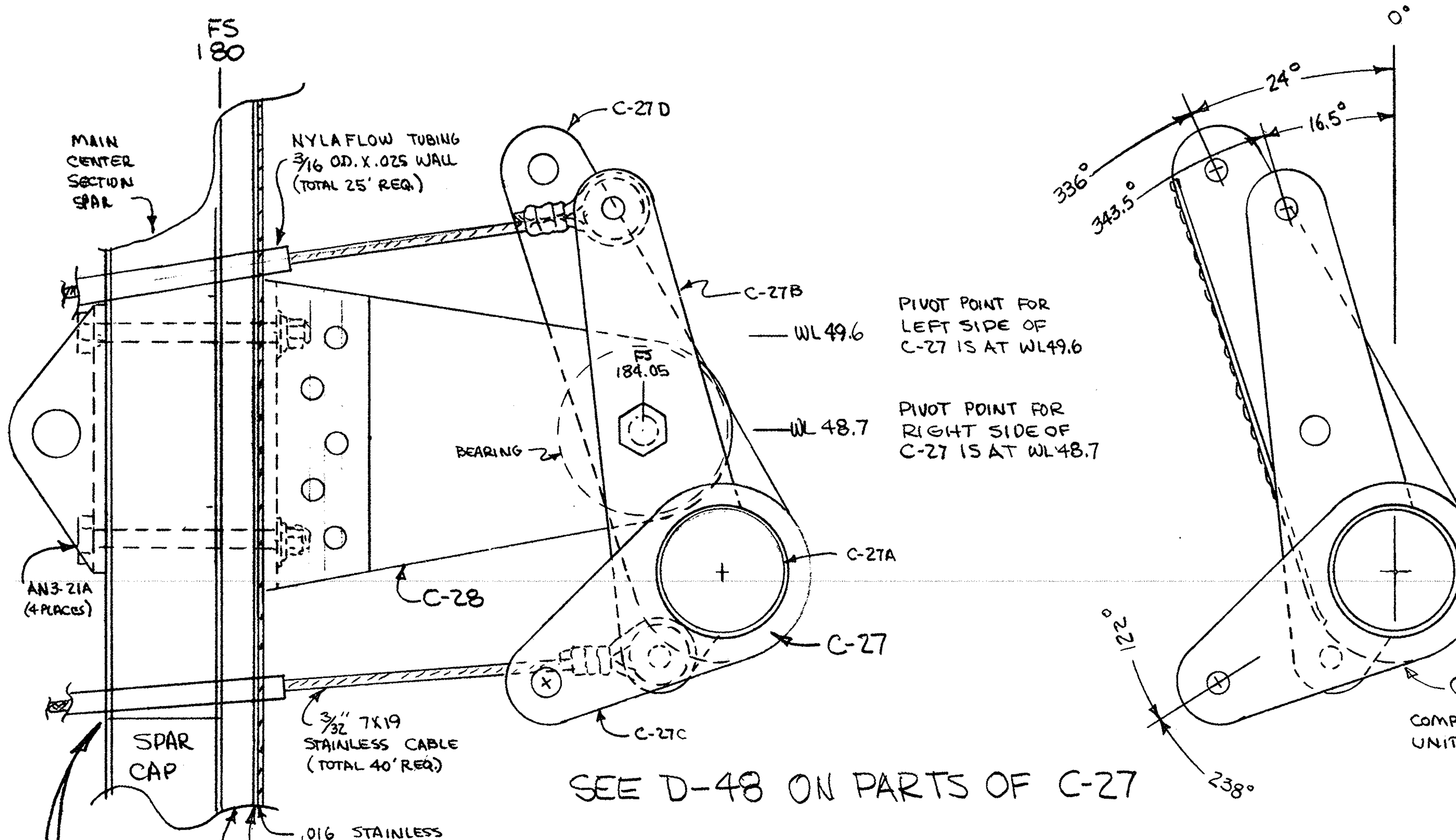
"FOUR ARE USED ON CANARD ATCH TABS & FOUR ON BKHD 57"



SHAPE OF CS-9 & CS-10

(CS-9) MAKE TWO FROM .032 2024-T3 ALUM & COUNTER SINK #10 HOLES

(CS-10) MAKE TWO FROM .063 2024-T3 ALUM. INSTALL ANCHOR NUT ON CENTER 1/4" HOLE SEE SECTION C-C



FS 180
MAIN CENTER SECTION SPAR
NYLAFLOW TUBING 3/16 OD. X .025 WALL (TOTAL 25' REQ.)
C-27D
C-27B
WL 49.6
FS 184.05
BEARING
WL 48.7
C-27A
C-27
C-28
AN3-21A (4 PLACES)
C-27C
3/32" 7X19 STAINLESS CABLE (TOTAL 40' REQ.)
SPAR CAP
.016 STAINLESS STEEL FIREWALL FACE
FIBERFRAX INSULATION
1/4" BIRCH AIRCRAFT PLYWOOD
0°
24°
16.5°
336°
343.5°
12°
238°
C-27 (SEE PAGE D-48)
COMPLETE WELDED UNIT (C-27 A-B-C-D)

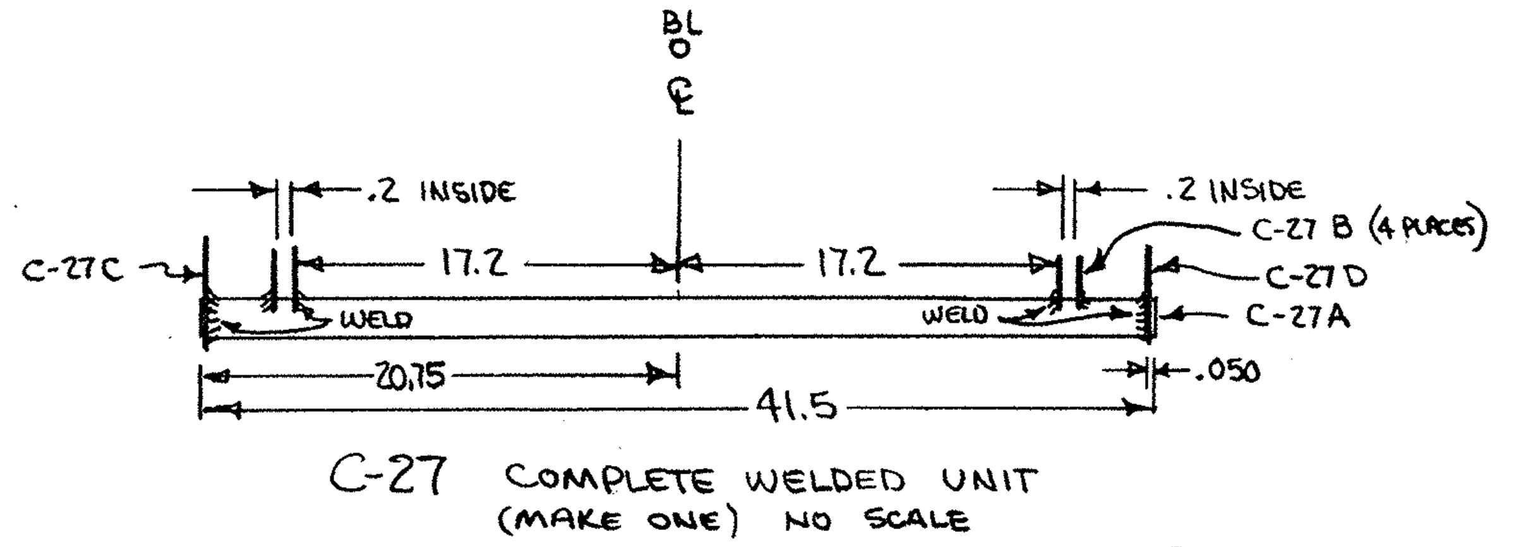
PIVOT POINT FOR LEFT SIDE OF C-27 IS AT WL49.6

PIVOT POINT FOR RIGHT SIDE OF C-27 IS AT WL48.7

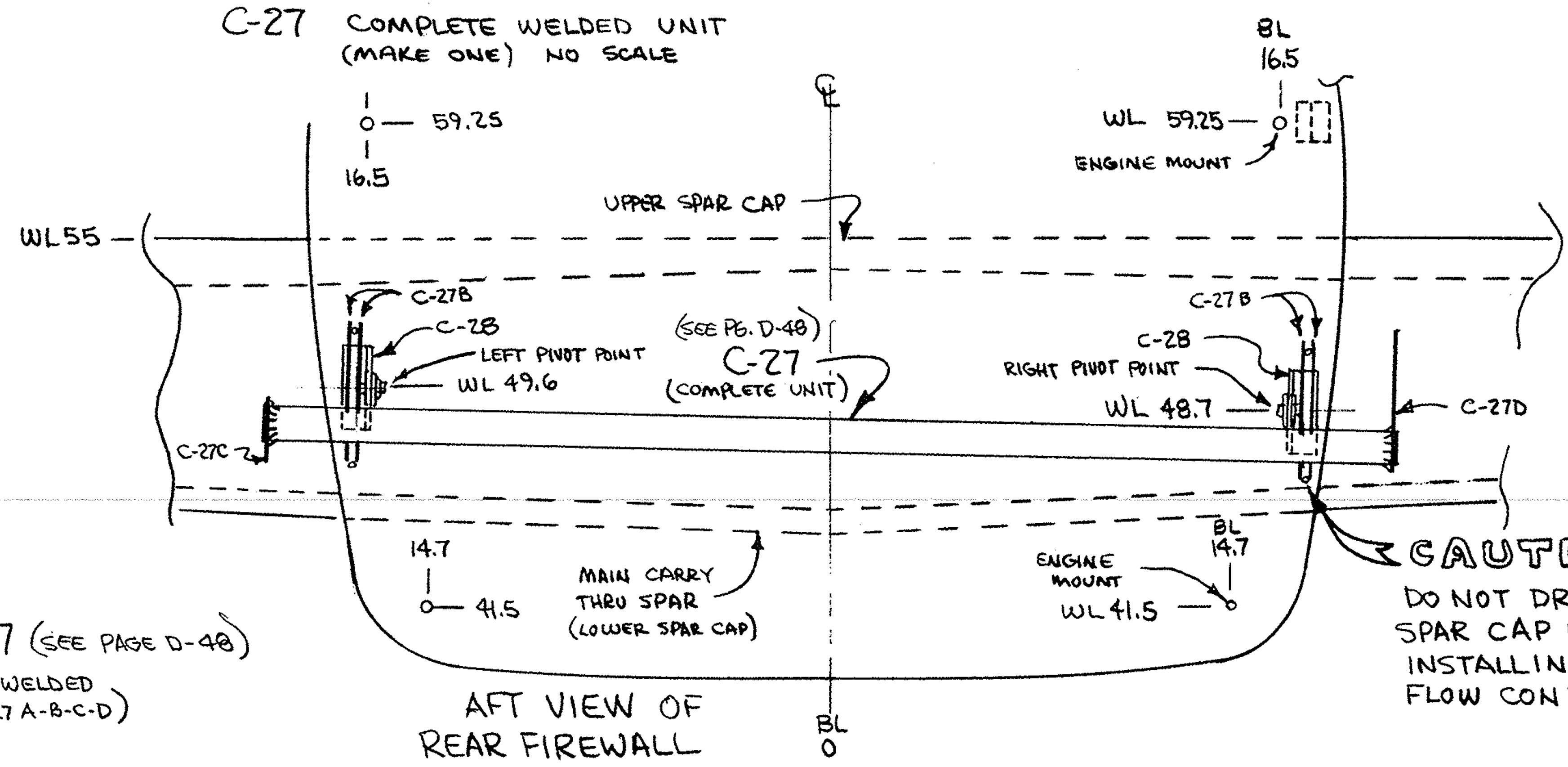
SEE D-48 ON PARTS OF C-27

USE CAUTION

DO NOT DRILL THRU SPAR CAP. RAISE COMPLETE C-27 IF NECESSARY. DRILL FROM INSIDE FUSELAGE TO LOCATE CAP.



C-27 COMPLETE WELDED UNIT (MAKE ONE) NO SCALE

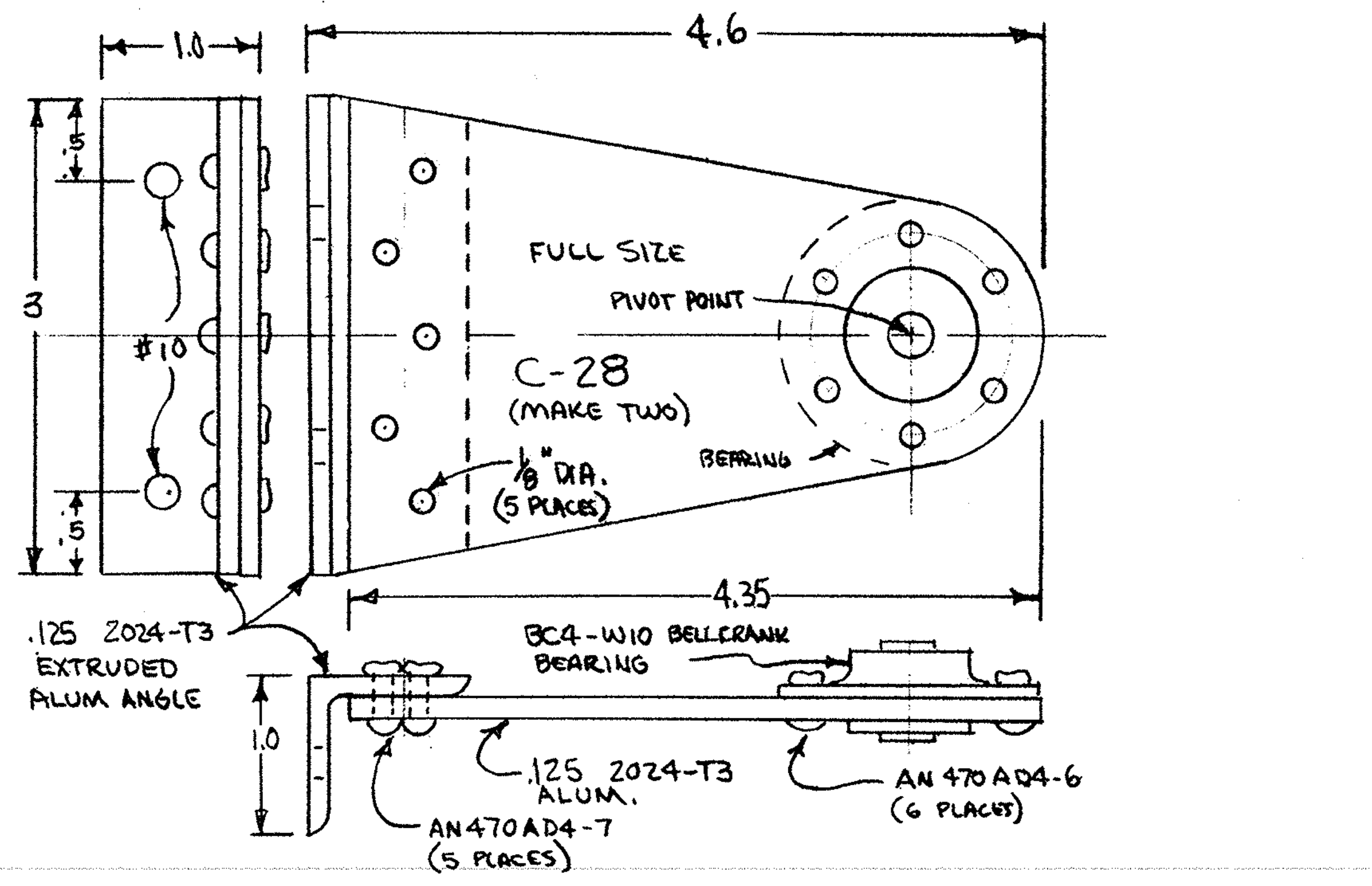


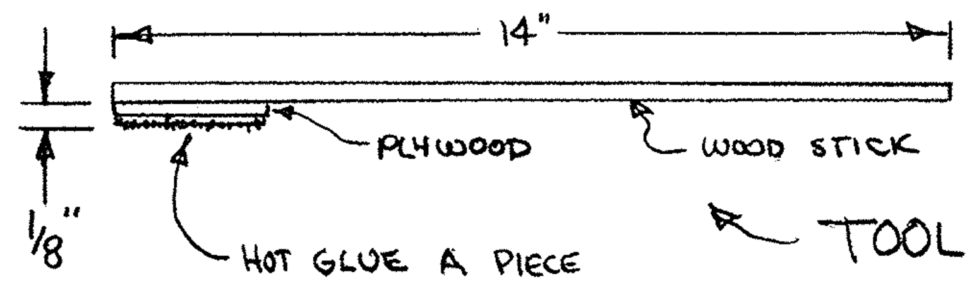
AFT VIEW OF REAR FIREWALL

NOTE: SLANT OF C-27 - USE CAUTION NOT TO DRILL INTO SPAR CAP.

CAUTION

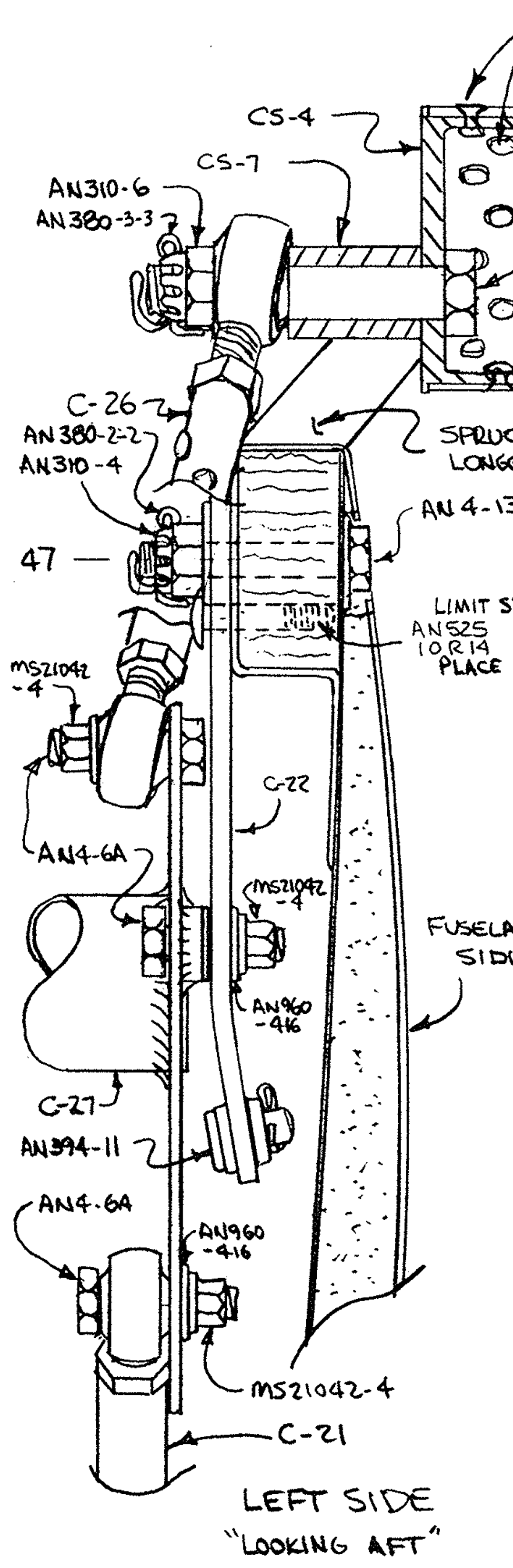
DO NOT DRILL THRU SPAR CAP WHEN INSTALLING NYLA-FLOW CONDUIT



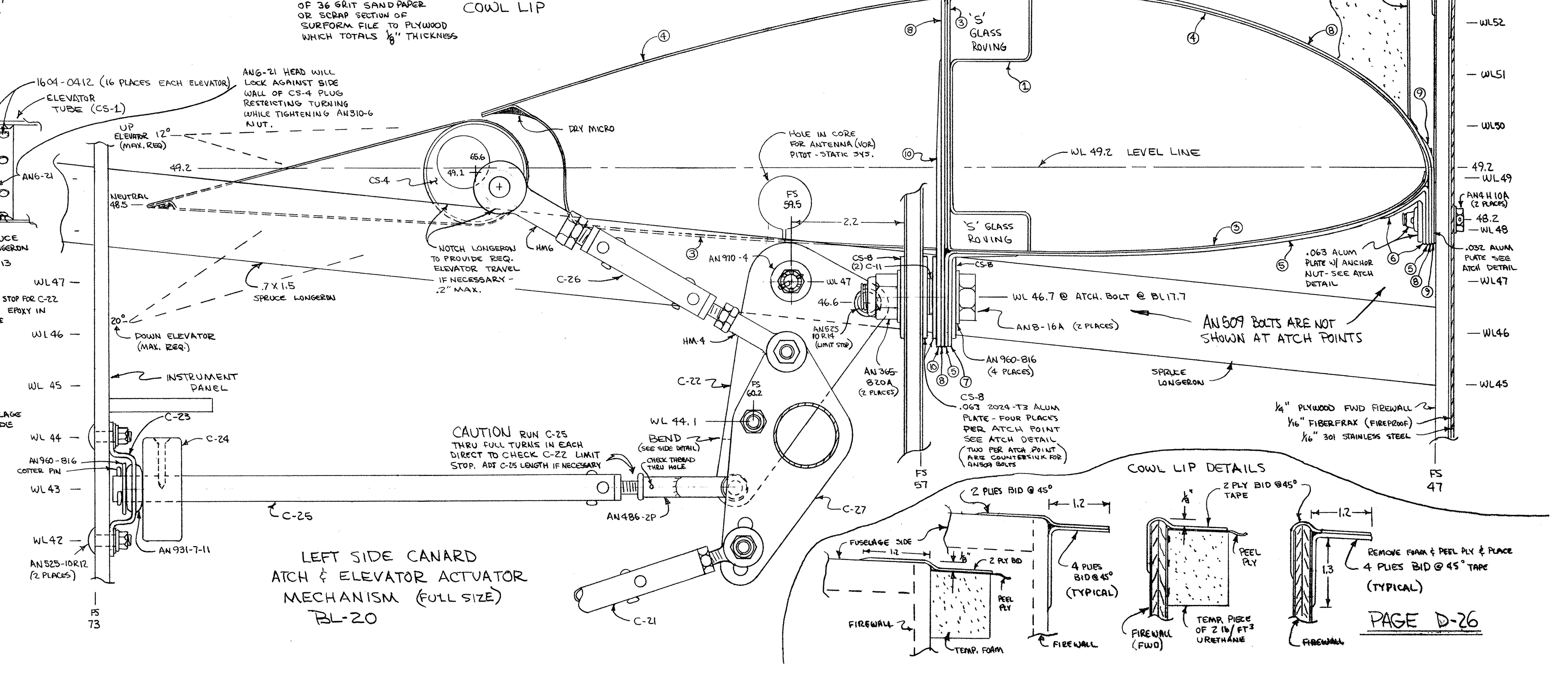


HOT GLUE A PIECE OF 36 GRIT SANDPAPER OR SCRAP SECTION OF SURFORM FILE TO PLYWOOD WHICH TOTALS 1/8" THICKNESS

TOOL TO FORM COWL LIP



LEFT SIDE "LOOKING AFT"

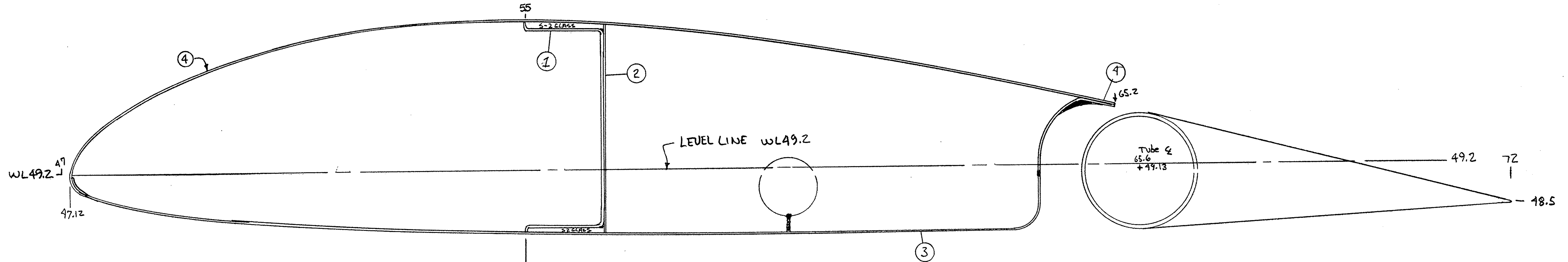


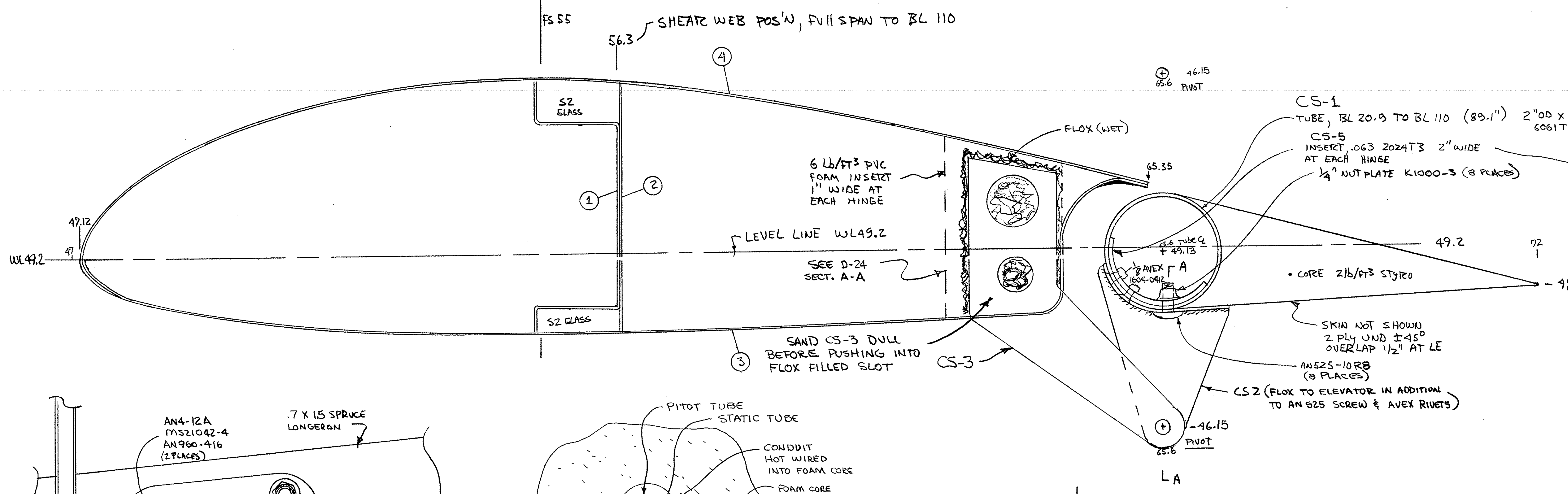
1604-0412 (16 PLACES EACH ELEVATOR)
ELEVATOR TUBE (CS-1)
AN6-21 HEAD WILL LOCK AGAINST SIDE WALL OF CS-4 PLUG RESTRICTING TURNING WHILE TIGHTENING AN310-6 NUT.
AN6-21
SPRUCE LONGERON
AN4-13
LIMIT STOP FOR C-22 AN525 10R14 EPOXY IN PLACE
WL47
WL46
WL 45
WL 44
AN960-816 COTTER PIN
WL 43
WL42
AN525-10R12 (2 PLACES)
FS 73
UP ELEVATOR 12° (MAX. REQ)
49.2
NEUTRAL 48.5
20°
DOWN ELEVATOR (MAX. REQ.)
INSTRUMENT PANEL
C-23
C-24
AN931-7-11
C-25
CAUTION RUN C-25 THRU FULL TURNS IN EACH DIRECT TO CHECK C-22 LIMIT STOP. ADJ C-25 LENGTH IF NECESSARY
BEND (SEE SIDE DETAIL)
CHECK THREAD THRU HOLE
AN486-2P
WL 44.1
C-22
FS 60.2
HM-4
C-27
C-21
④
DRY MICRO
65.6
49.1
CS-4
NOTCH LONGERON TO PROVIDE REQ. ELEVATOR TRAVEL IF NECESSARY - .2" MAX.
HM6
.7 X 1.5 SPRUCE LONGERON
C-26
HOLE IN CORE FOR ANTENNA (VOR) PITOT-STATIC SYS.
FS 59.5
2.2
③
AN 970-4
WL 47
CS-8 (2) C-11
46.6
AN525 10R14 (LIMIT STOP)
AN 365-820A (2 PLACES)
WL 52.7
⑧
③ 'S' GLASS ROVING
①
④
⑩
WL 49.2 LEVEL LINE
'S' GLASS ROVING
③
⑤
CS-8
WL 46.7 @ ATCH. BOLT @ BL17.7
AN8-16A (2 PLACES)
AN 960-816 (4 PLACES)
⑩ ⑧ ⑤ ⑦
CS-8 .063 2024-T3 ALUM PLATE - FOUR PLACES PER ATCH POINT SEE ATCH DETAIL (TWO PER ATCH POINT ARE COUNTERSINK FOR AN509 BOLTS)
FS 57
SPRUCE LONGERON
CANARD
CANARD FAIRING - 2 PLY BID @ 45°
SEE DETAILS OF COWL LIP BELOW
X-40 POUR IN PLACE FOAM SEE PHOTO 480
1 PLY BID
⑧
⑨
⑨
.063 ALUM PLATE W/ ANCHOR NUT - SEE ATCH DETAIL
⑥
⑦
⑧
⑨
AN4H10A (2 PLACES)
.032 ALUM PLATE SEE ATCH DETAIL
WL52
WL51
WL50
49.2
WL49
48.2
WL 48
WL47
WL46
WL45
1/4" PLYWOOD FWD FIREWALL
1/16" FIBERFRAX (FIREPROOF)
1/16" 301 STAINLESS STEEL
FS 47
2 PLIES BID @ 45°
1.2
FUSELAGE SIDE
1.2
1/8"
2 PLY BID
PEEL PLY
FIREWALL
TEMP. FOAM
4 PLIES BID @ 45° (TYPICAL)
FIREWALL
2 PLY BID @ 45° TAPE
1/8"
PEEL PLY
FIREWALL (FWD)
TEMP. PIECE OF 2 lb/FT³ URETHANE
1.2
1.3
REMOVE FOAM & PEEL PLY & PLACE 4 PLIES BID @ 45° TAPE (TYPICAL)
FIREWALL

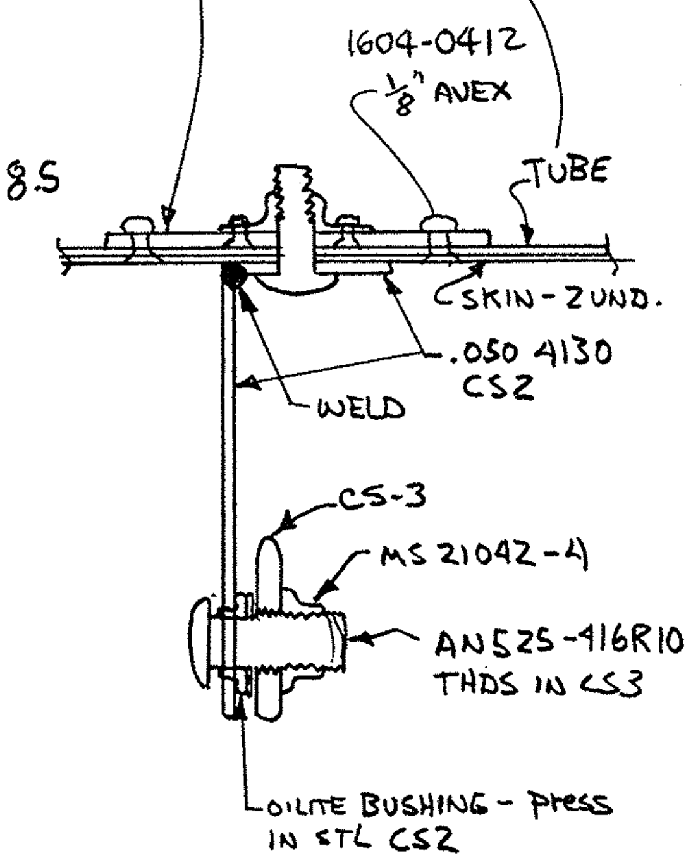
AN509 BOLTS ARE NOT SHOWN AT ATCH POINTS

COWL LIP DETAILS

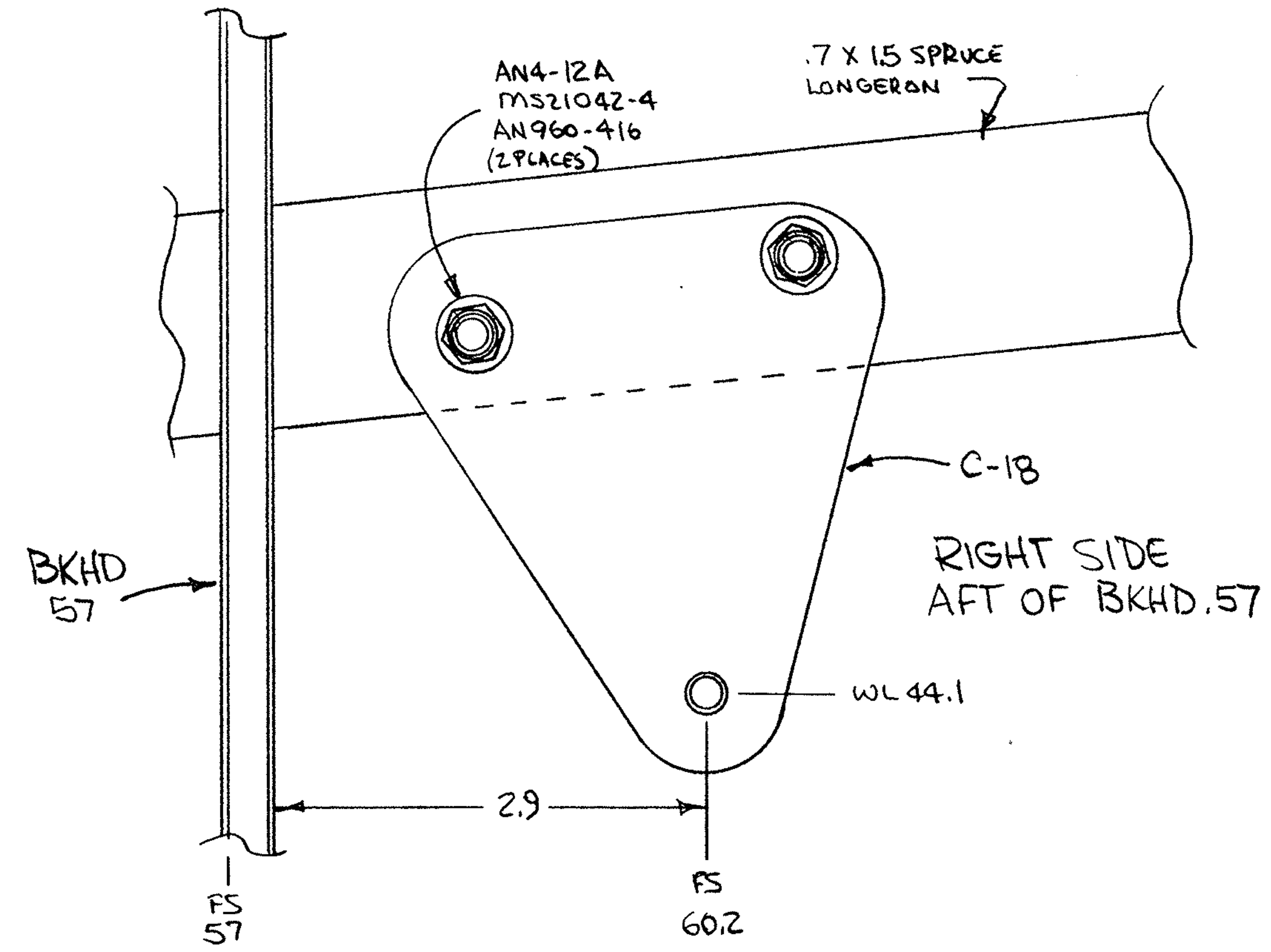
LEFT SIDE CANARD ATCH & ELEVATOR ACTUATOR MECHANISM (FULL SIZE) BL-20



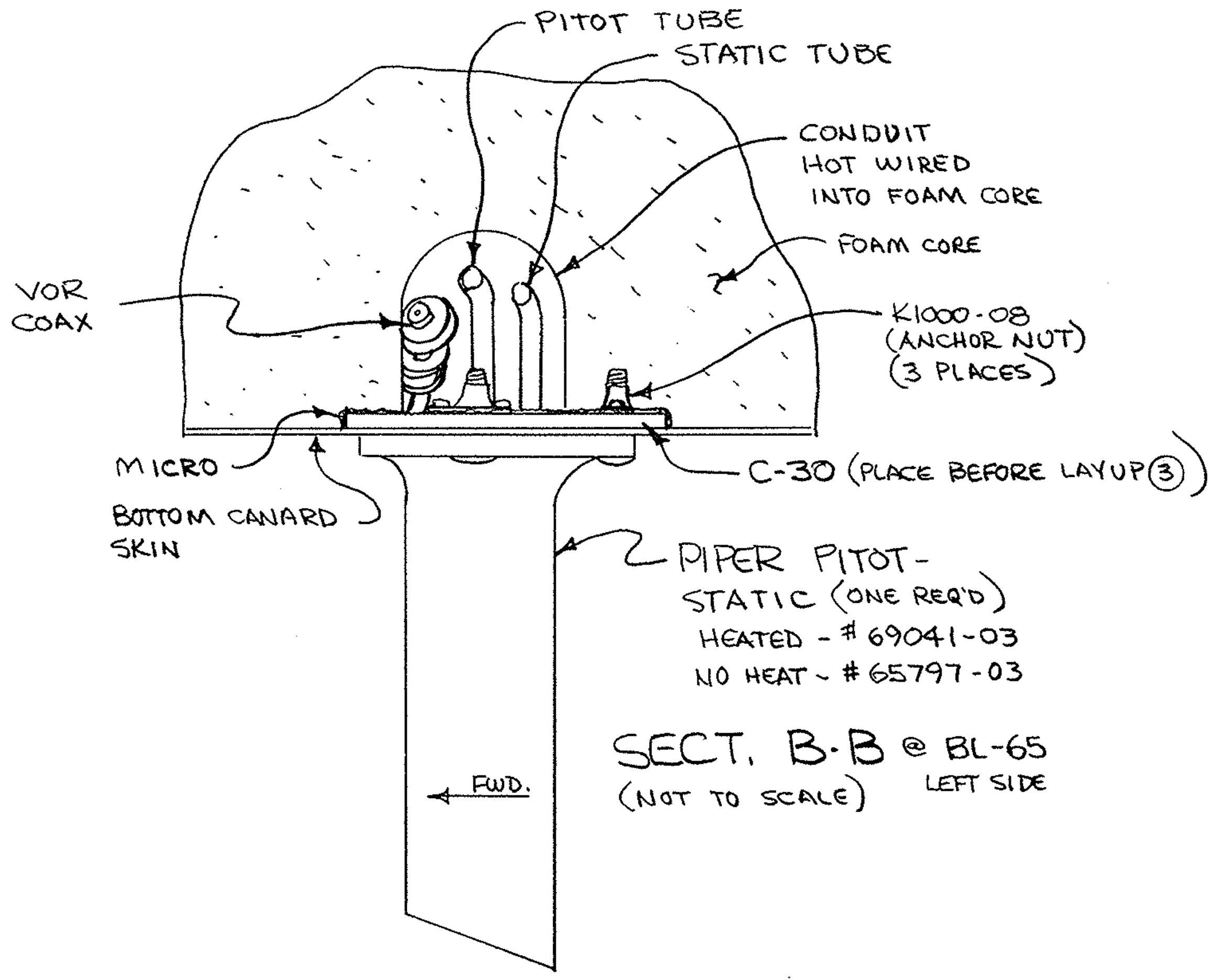

FS 55
56.3
SHEAR WEB POS'N, FULL SPAN TO BL 110
④
S2 GLASS
S2 GLASS
①
②
③
WL49.2
47.12
47
LEVEL LINE WL49.2
6 Lb/FT³ PVC FOAM INSERT 1" WIDE AT EACH HINGE
SEE D-24 SECT. A-A
FLOX (WET)
65.35
SAND CS-3 DULL BEFORE PUSHING INTO FLOX FILLED SLOT
CS-3
65.6 46.15 PIVOT
CS-1
TUBE, BL 20.9 TO BL 110 (89.1") 2"OD x 049 WALL 6061T6 or 2024T3
CS-5
INSERT, .063 2024T3 2" WIDE AT EACH HINGE
¼" NUT PLATE K1000-3 (8 PLACES)
65.6 Tube ℄ + 49.13
49.2
72
48.5
⅛ AVEX 1604-0412
A
A
• CORE 2lb/FT³ STYRO
SKIN NOT SHOWN 2 PLY UND ±45° OVERLAP ½" AT LE
AN525-10R8 (8 PLACES)
CS2 (FLOX TO ELEVATOR IN ADDITION TO AN525 SCREW & AVEX RIVETS)
46.15
65.6
PIVOT



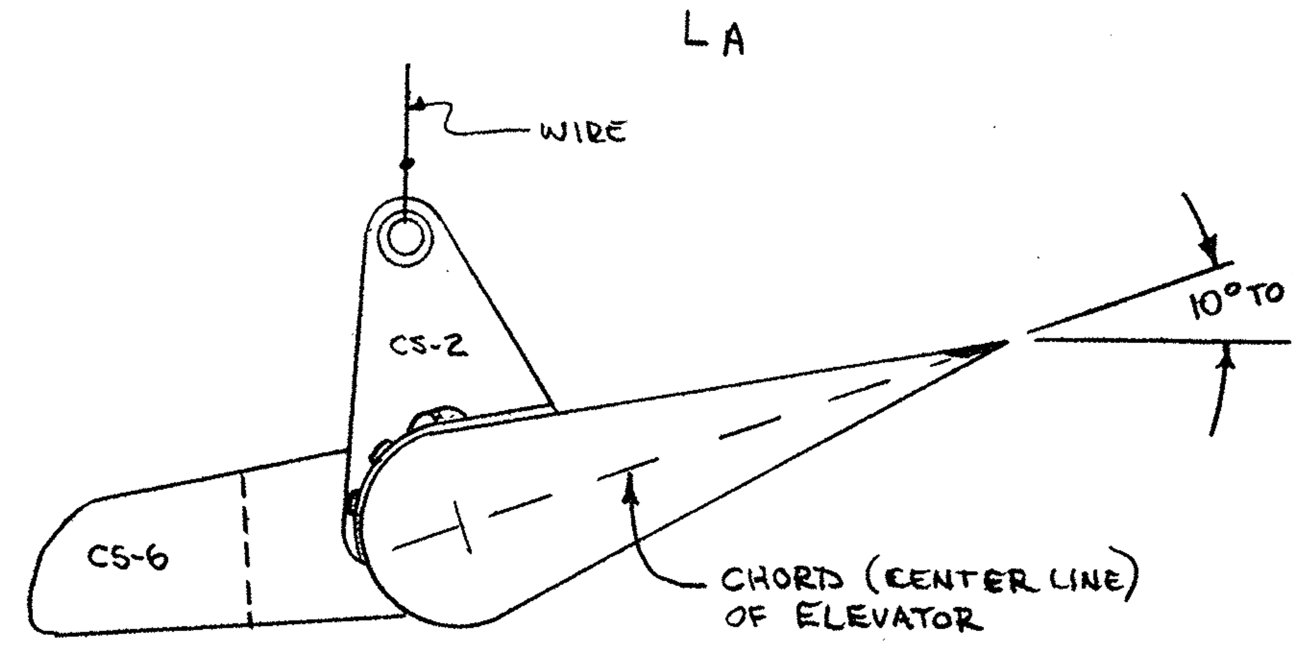
SECT A A
TYP AT EACH HINGE



RIGHT SIDE
AFT OF BKHD.57

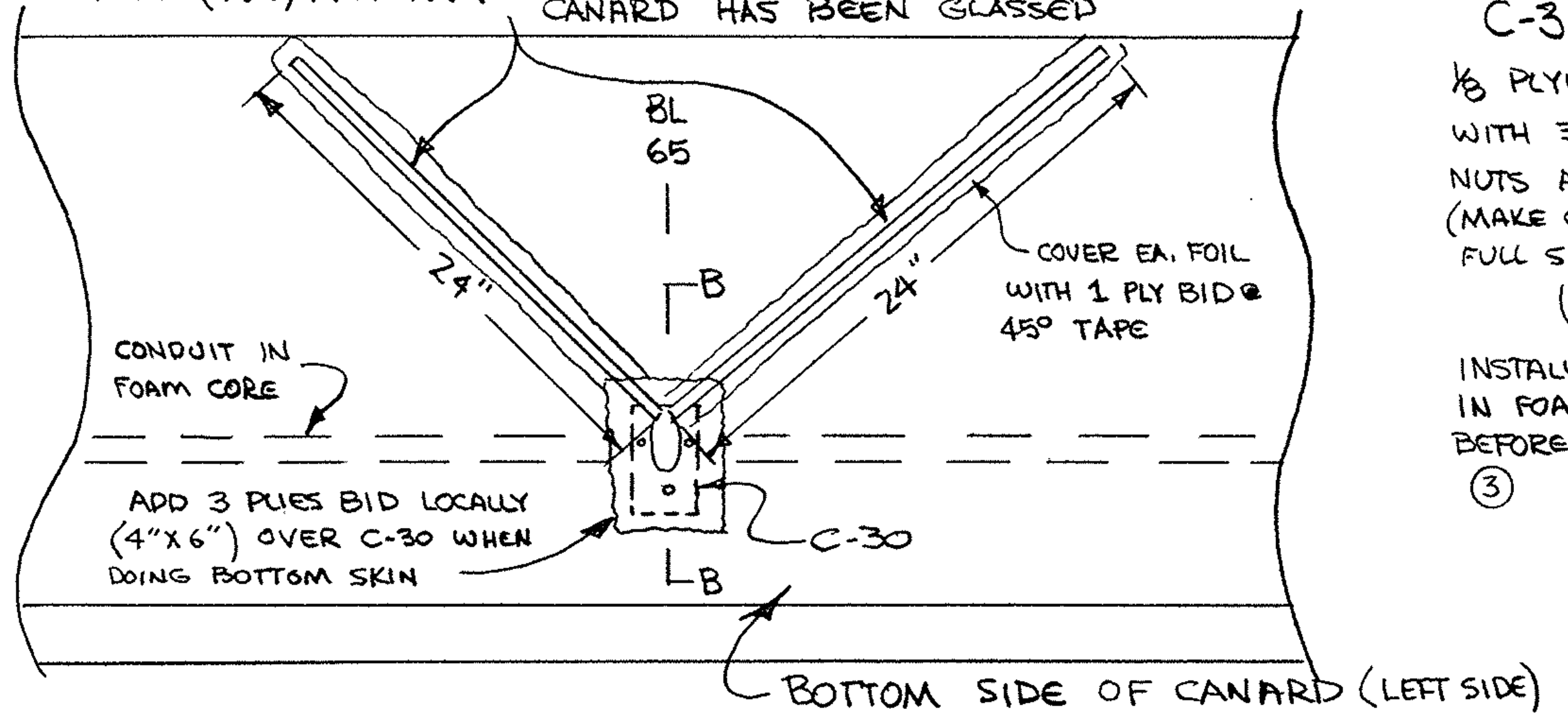

PITOT TUBE
STATIC TUBE
CONDUIT HOT WIRED INTO FOAM CORE
FOAM CORE
VOR COAX
K1000-08 (ANCHOR NUT) (3 PLACES)
MICRO
BOTTOM CANARD SKIN
C-30 (PLACE BEFORE LAYUP ③)
PIPER PITOT-STATIC (ONE REQ'D)
HEATED - # 69041-03
NO HEAT - # 65797-03
FWD.

SECT. B-B @ BL-65 LEFT SIDE
(NOT TO SCALE)



WITH ELEVATOR SUSPENDED FROM FINE WIRE. ELEVATOR SHOULD HANG LEADING EDGE DOWN AND BE WITHIN 10° TO 20° LIMIT SHOWN AFTER PAINTING. IF ADDED WEIGHT IS NEEDED DO NOT ADD MORE THEN 5 OZ. MAX. - IF MORE THEN 5 OZ's IS REQ. REBUILD ELEVATOR. ADD ANY WEIGHT TO TIP OF CS-6

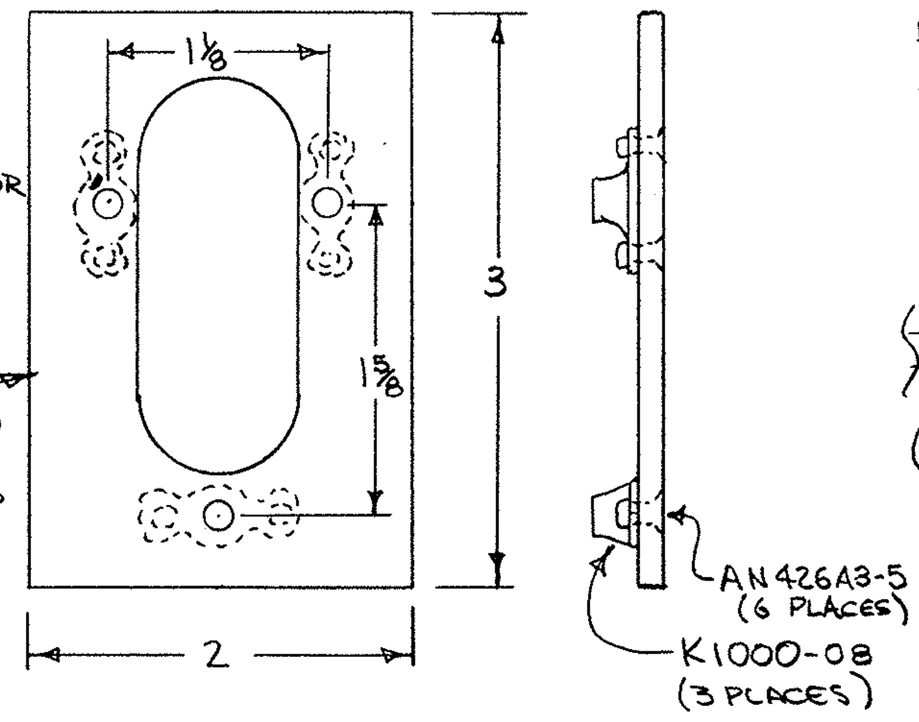
NAV (VOR) ANTENNA

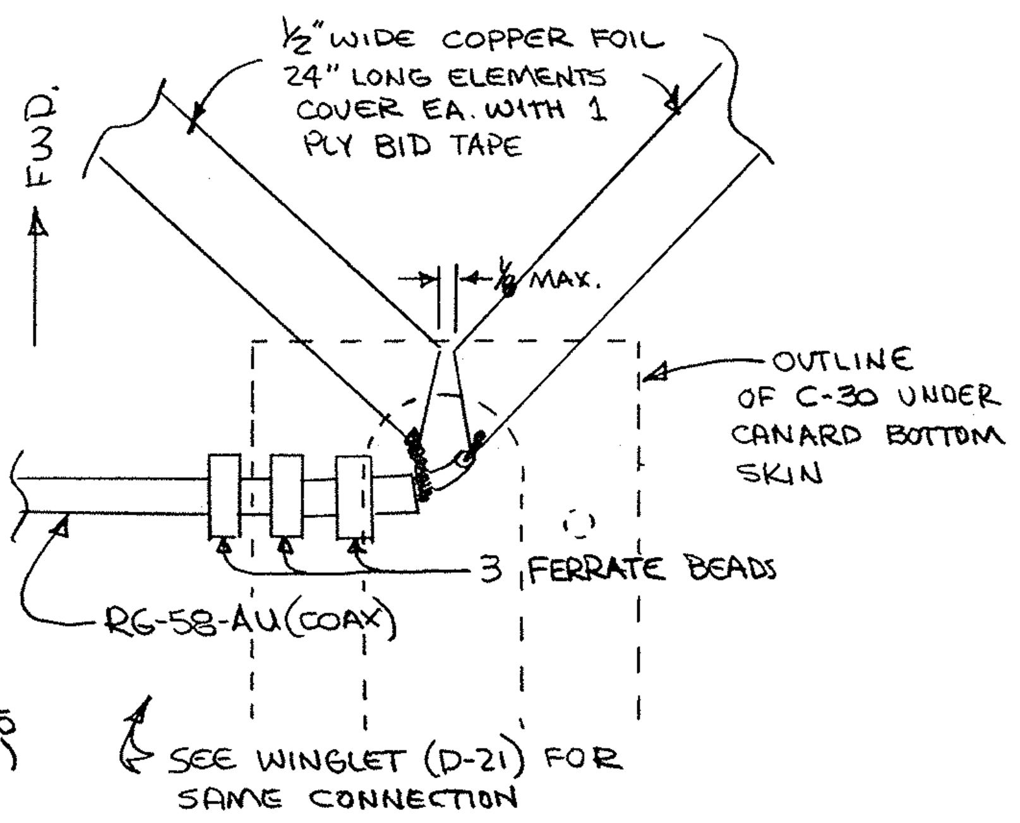

PLACE COPPER FOIL ELEMENTS AFTER CANARD HAS BEEN GLASSED
BL 65
B
B
24"
24"
COVER EA. FOIL WITH 1 PLY BID @ 45° TAPE
CONDUIT IN FOAM CORE
ADD 3 PLIES BID LOCALLY (4"X6") OVER C-30 WHEN DOING BOTTOM SKIN
C-30
BOTTOM SIDE OF CANARD (LEFT SIDE)

C-30

⅛ PLYWOOD WITH 3 ANCHOR NUTS ATCH'D (MAKE ONE) FULL SIZE

INSTALL C-30 IN FOAM BEFORE LAYUP ③



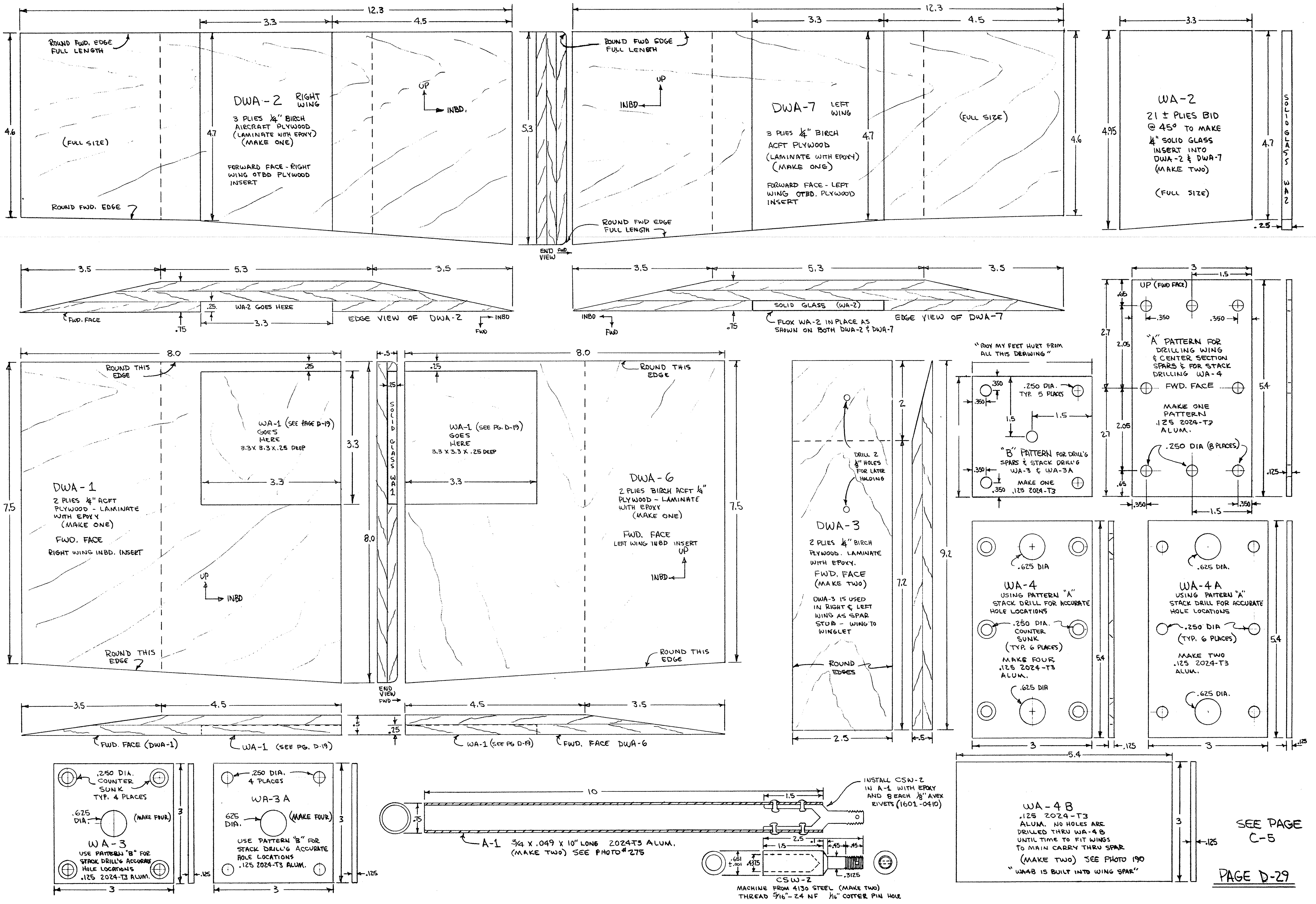

FWD.
½" WIDE COPPER FOIL 24" LONG ELEMENTS COVER EA. WITH 1 PLY BID TAPE
⅛ MAX.
OUTLINE OF C-30 UNDER CANARD BOTTOM SKIN
3 FERRATE BEADS
RG-58-AU (COAX)
SEE WINGLET (D-21) FOR SAME CONNECTION

CANARD LAYUP SCHEDULES

① SHEAR WEB (FWD. CORES)	2 PLIES UND ± 45°	BL+110 TO BL-110
	ADD 2 PLIES UND ± 45°	BL+85 TO BL-85
	ADD 2 PLIES UND ± 45°	BL+55 TO BL-55
	ADD 2 PLIES UND ± 45°	BL+35 TO BL-35 ← EIGHT TOTAL PLIES UND THRU CENTER
② SHEAR WEB (AFT. CORES)	2 PLIES UND ± 45°	BL+20 TO BL+110 & BL-20 TO BL-110
③ BOTTOM SKIN (INSTALL C-30)	2 PLIES UND ± 45° (ENTIRE SURFACE) PLUS ADD (3B), (3C) & (3D), EACH BEING 1 PLY BID @ 45° @ LOCATION SHOWN ON D-23 (ALL 5 PLIES OF BOTTOM SKIN LAP ONTO FULL SURFACE OF SHEAR WEB @ BL-20 TO BL+20)	
④ TOP SKIN (INSTALL FOAM HARD POINT - SEE D-24)	2 PLIES UND ± 45° (ENTIRE SURFACE) AND ADD (4A) 1 PLY UND @ SPANWISE ORIENT. - 11" WIDE STRIP FROM BL+127 TO BL-127 PLUS ADD (4B), (4C) & (4D), EACH BEING 1 PLY BID @ 45° AND LAP ONTO FULL SURFACE OF SHEAR WEB - SAME AS (3B), (3C) & (3D)	
ATTACH LAYUPS (LIFT TABS)		
⑤	4 PLIES UND WRAP @ ORIENT SHOWN - 3" WIDE	
⑥	12 PLIES BID @ 45° - 3" WIDE	
⑦	18 PLIES BID @ 45° - 3" WIDE	
⑧	6 PLIES UND WRAP @ ORIENT SHOWN - 3" WIDE	
⑨	4 PLIES BID @ 45° - 3" WIDE	
⑩	6 PLIES BID @ 45° - 3" WIDE	

(1A) (1B)	1 PLY BID @ 45° - WING ATCH BOLT ACCESS OPENINGS SEE D-30
(2A) (2B) (2C)	4 PLIES BID @ 45° - PLIES BETWEEN PLYWOOD HARD POINT & WING FOAM CORE
(3A)	4 PLIES UND ± 45° - BL 19.5 TO BL 184.9 } SHEAR WEB
(3B)	2 PLIES UND ± 45° - BL 19.5 TO BL 117 } SHEAR WEB
(3C)	2 PLIES UND ± 45° - BL 48 TO BL 68 } SHEAR WEB
④	2 PLIES UND ± 45° - BL 55.5 TO BL 180 } SHEAR WEB
⑤	SOLID 'S' GLASS - BOTTOM SPAR CAP
⑥	2 PLIES UND ± 45° - WING BOTTOM SKIN
⑦	SOLID 'S' GLASS - TOP SPAR CAP
⑧	2 PLIES UND ± 45° PLUS 1 ADD'L PLY UND @ 0° TO AILERON HINGE - WING TOP SKIN
⑨	3 PLIES BID @ 45° - END RIB FWD. SPAR @ BL 59.35
⑩	6 PLIES UND 3" WIDE @ ORIENT. SHOWN - OTBD. WING ATCH POINT
⑪	3 PLIES UND 3" WIDE @ ORIENT. SHOWN - INBD. WING ATCH POINT
⑫	3 PLIES BID @ 45° - END RIB @ BL 19.5
⑬	3 PLIES BID @ 45° FULL LENGTH OF AILERON OPENING IN WING + ADD 1 PLY BID @ EACH AILERON HINGE LOCATION
⑭	2 PLIES BID @ 45° - END RIB @ BL 112.85
⑮	1 PLY BID @ 45° EXTENDING FULL LENGTH OF AILERON
(15A)	1 ADD'L PLY BID @ 45° AT EACH AILERON HINGE LOCATIONS
⑯	1 PLY BID @ 45° - END RIB - OTBD END OF AILERON
⑰	2 PLY BID @ 45° - END RIB - INBD. END OF AILERON

WING LAYUP SCHEDULE



ROUND FWD. EDGE FULL LENGTH

DWA-2 RIGHT WING

3 PLIES ¼" BIRCH AIRCRAFT PLYWOOD (LAMINATE WITH EPOXY) (MAKE ONE)

(FULL SIZE)

FORWARD FACE - RIGHT WING OTBD PLYWOOD INSERT

ROUND FWD. EDGE

ROUND FWD EDGE FULL LENGTH

DWA-7 LEFT WING

3 PLIES ¼" BIRCH ACFT PLYWOOD (LAMINATE WITH EPOXY) (MAKE ONE)

(FULL SIZE)

FORWARD FACE - LEFT WING OTBD. PLYWOOD INSERT

ROUND FWD EDGE FULL LENGTH

WA-2

21 ± PLIES BID @ 45° TO MAKE ¼" SOLID GLASS INSERT INTO DWA-2 & DWA-7 (MAKE TWO)

(FULL SIZE)

WA-2 GOES HERE

FWD. FACE

EDGE VIEW OF DWA-2

SOLID GLASS (WA-2)

FLOX WA-2 IN PLACE AS SHOWN ON BOTH DWA-2 & DWA-7

EDGE VIEW OF DWA-7

UP (FWD FACE)

"A" PATTERN FOR DRILLING WING & CENTER SECTION SPARS & FOR STACK DRILLING WA-4

FWD. FACE

MAKE ONE PATTERN .125 2024-T3 ALUM.

.250 DIA (8 PLACES)

"BOY MY FEET HURT FROM ALL THIS DRAWING"

.250 DIA. TYP. 5 PLACES

"B" PATTERN FOR DRILL'G SPARS & STACK DRILL'G WA-3 & WA-3A

MAKE ONE .125 2024-T3

ROUND THIS EDGE

WA-1 (SEE PAGE D-19) GOES HERE 3.3 X 3.3 X .25 DEEP

DWA-1

2 PLIES ¼" ACFT PLYWOOD - LAMINATE WITH EPOXY (MAKE ONE)

FWD. FACE

RIGHT WING INBD. INSERT

ROUND THIS EDGE

WA-1 (SEE PG. D-19) GOES HERE 3.3 X 3.3 X .25 DEEP

ROUND THIS EDGE

DWA-6

2 PLIES BIRCH ACFT ¼" PLYWOOD - LAMINATE WITH EPOXY (MAKE ONE)

FWD. FACE

LEFT WING INBD INSERT

ROUND THIS EDGE

FWD. FACE (DWA-1)

WA-1 (SEE PG. D-19)

WA-1 (SEE PG D-19)

FWD. FACE DWA-6

DRILL 2 ⅛" HOLES FOR LATER HOLDING

DWA-3

2 PLIES ¼" BIRCH PLYWOOD. LAMINATE WITH EPOXY.

FWD. FACE (MAKE TWO)

DWA-3 IS USED IN RIGHT & LEFT WING AS SPAR STUB - WING TO WINGLET

ROUND EDGES

WA-4

USING PATTERN "A" STACK DRILL FOR ACCURATE HOLE LOCATIONS

.625 DIA

.250 DIA. COUNTER SUNK (TYP. 6 PLACES)

MAKE FOUR .125 2024-T3 ALUM.

WA-4 A

USING PATTERN "A" STACK DRILL FOR ACCURATE HOLE LOCATIONS

.625 DIA.

.250 DIA (TYP. 6 PLACES)

MAKE TWO .125 2024-T3 ALUM.

WA-3

.250 DIA. COUNTER SUNK TYP. 4 PLACES

.625 DIA.

(MAKE FOUR)

USE PATTERN "B" FOR STACK DRILL'G ACCURATE HOLE LOCATIONS .125 2024-T3 ALUM.

WA-3 A

.250 DIA. 4 PLACES

.625 DIA.

(MAKE FOUR)

USE PATTERN "B" FOR STACK DRILL'G ACCURATE HOLE LOCATIONS .125 2024-T3 ALUM.

A-1 ¾ X .049 X 10" LONG 2024T3 ALUM. (MAKE TWO) SEE PHOTO # 275

INSTALL CSW-2 IN A-1 WITH EPOXY AND 8 EACH ⅛" AVEX RIVETS (1601-0410)

CSW-2

MACHINE FROM 4130 STEEL (MAKE TWO)
THREAD 5⁄16"-24 NF 1⁄16" COTTER PIN HOLE

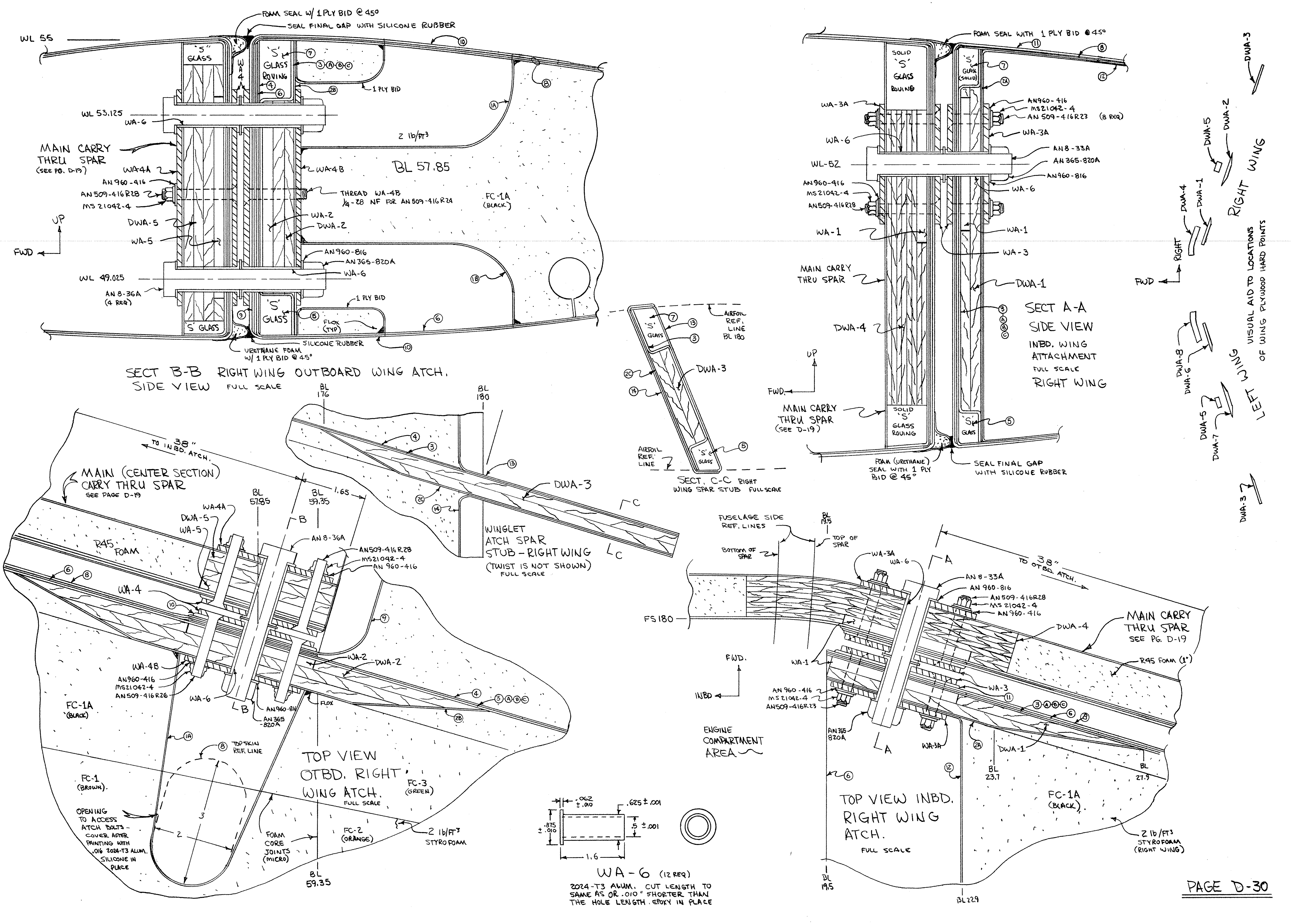
WA-4 B

.125 2024-T3 ALUM. NO HOLES ARE DRILLED THRU WA-4 B UNTIL TIME TO FIT WINGS TO MAIN CARRY THRU SPAR

(MAKE TWO) SEE PHOTO 190

"WA4B IS BUILT INTO WING SPAR"

SEE PAGE C-5


WL 55
FOAM SEAL W/ 1 PLY BID @ 45°
SEAL FINAL GAP WITH SILICONE RUBBER
⑩
'S' GLASS
WA-4
'S' GLASS ROVING
⑦
③Ⓐ⒝Ⓒ
④
⑥
②B
1 PLY BID
⑧
①A
WL 53.125
WA-6
2 lb/FT³
MAIN CARRY THRU SPAR (SEE PG. D-19)
WA4A
WA-4B
BL 57.85
AN960-416
AN509-416R28
MS 21042-4
THREAD WA-4B 1/4-28 NF FOR AN509-416R24
FC-1A (BLACK)
UP
FWD
DWA-5
WA-5
WA-2
DWA-2
AN960-816
AN365-820A
WA-6
WL 49.025
AN 8-36A (4 REQ)
①B
'S' GLASS
⑨
⑤
FLOX (TYP)
⑥
'S' GLASS
SILICONE RUBBER
⑩
URETHANE FOAM W/ 1 PLY BID @ 45°
SECT B-B RIGHT WING OUTBOARD WING ATCH. SIDE VIEW FULL SCALE
FOAM SEAL WITH 1 PLY BID @ 45°
⑪
⑧
⑫
SOLID 'S' GLASS ROVING
'S' GLASS (SOLID)
⑦
②A
WA-3A
AN960-416
MS21042-4
AN 509-416R23 (8 REQ)
WA-6
WA-3A
WL-52
AN8-33A
AN365-820A
AN960-816
AN960-416
MS21042-4
AN509-416R28
WA-6
WA-1
WA-1
WA-3
MAIN CARRY THRU SPAR
DWA-1
③Ⓐ⒝Ⓒ
DWA-4
SECT A-A SIDE VIEW INBD. WING ATTACHMENT FULL SCALE RIGHT WING
UP
FWD.
MAIN CARRY THRU SPAR (SEE D-19)
SOLID 'S' GLASS ROVING
'S' GLASS
⑤
FOAM (URETHANE) SEAL WITH 1 PLY BID @ 45°
SEAL FINAL GAP WITH SILICONE RUBBER
DWA-3
DWA-5
DWA-2
DWA-4
DWA-1
RIGHT WING
RIGHT
FWD
VISUAL AID TO LOCATIONS OF WING PLYWOOD HARD POINTS
DWA-8
DWA-6
LEFT WING
DWA-5
DWA-7
DWA-3
'S' GLASS
⑦
⑬
③
AIRFOIL REF. LINE BL 180
②C
⑭
DWA-3
AIRFOIL REF. LINE
'S' GLASS
⑤
SECT. C-C RIGHT WING SPAR STUB FULL SCALE
BL 176
BL 180
④
③
⑬
②C
⑭
DWA-3
C
C
WINGLET ATCH SPAR STUB - RIGHT WING (TWIST IS NOT SHOWN) FULL SCALE
38" TO INBD. ATCH.
MAIN (CENTER SECTION) CARRY THRU SPAR SEE PAGE D-19
BL 57.85
BL 59.35
1.65
WA-4A
DWA-5
WA-5
B
AN 8-36A
AN509-416R28
MS21042-4
AN 960-416
R45 FOAM
⑥ ⑧
WA-4
⑩
⑨
WA-4B
AN960-416
MS21042-4
AN509-416R26
WA-6
B
WA-2
DWA-2
AN960-816
AN 365-820A
FLOX
④
③Ⓐ⒝Ⓒ
②B
FC-1A (BLACK)
①A
⑧ TOP SKIN REF. LINE
TOP VIEW OTBD. RIGHT WING ATCH. FULL SCALE
FC-1 (BROWN)
3
2
FC-3 (GREEN)
OPENING TO ACCESS ATCH BOLTS - COVER AFTER PAINTING WITH .016 2024-T3 ALUM. SILICONE IN PLACE
FOAM CORE JOINTS (MICRO)
FC-2 (ORANGE)
2 lb/FT³ STYROFOAM
BL 59.35
.062 ±.010
.625 ±.001
.875 ±.010
.5 ±.001
1.6
WA-6 (12 REQ)
2024-T3 ALUM. CUT LENGTH TO SAME AS OR .010" SHORTER THAN THE HOLE LENGTH. EPOXY IN PLACE
FUSELAGE SIDE REF. LINES
BL 19.5
BOTTOM OF SPAR
TOP OF SPAR
WA-3A
WA-6
A
38" TO OTBD. ATCH.
AN8-33A
AN 960-816
AN509-416R28
MS21042-4
AN960-416
FS180
DWA-4
MAIN CARRY THRU SPAR SEE PG. D-19
R45 FOAM (1")
FWD.
INBD
WA-1
AN 960-416
MS21042-4
AN509-416R23
WA-3
⑪
③Ⓐ⒝Ⓒ
⑥
⑧
AN365 820A
WA-3A
②A
DWA-1
A
ENGINE COMPARTMENT AREA
⑫
BL 23.7
BL 27.9
⑥
TOP VIEW INBD. RIGHT WING ATCH. FULL SCALE
FC-1A (BLACK)
2 lb/FT³ STYROFOAM (RIGHT WING)
BL 19.5
BL 22.9

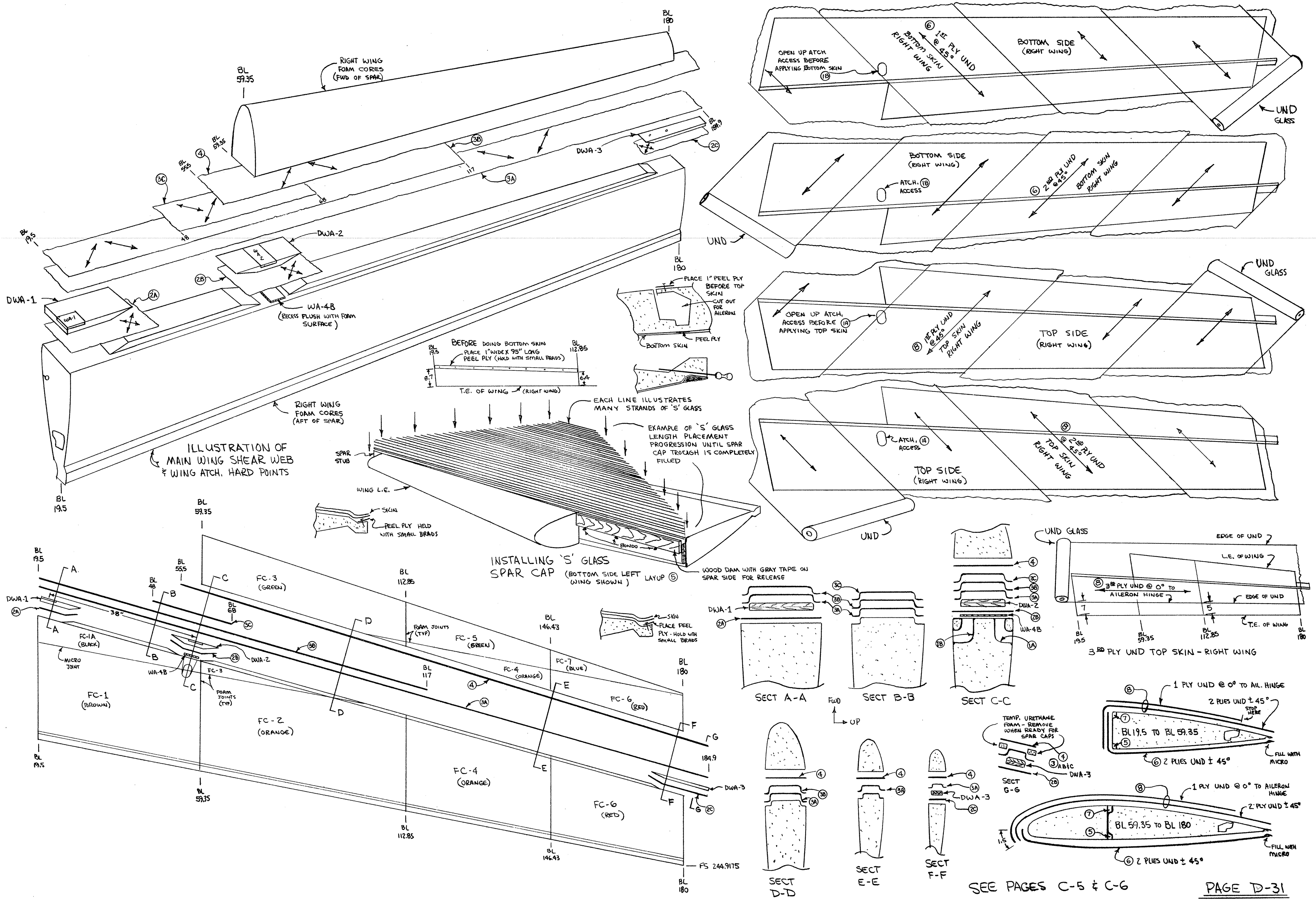


ILLUSTRATION OF MAIN WING SHEAR WEB & WING ATCH. HARD POINTS

BL 180
RIGHT WING FOAM CORES (FWD OF SPAR)
BL 59.35
BL 59.35
BL 184.9
BL 55.5
④
③B
DWA-3
②C
117
③A
③C
68
BL 19.5
48
DWA-2
WA-2
②B
DWA-1
WA-1
②A
WA-4B
(RECESS FLUSH WITH FOAM SURFACE)
BL 180
RIGHT WING FOAM CORES (AFT OF SPAR)
BL 19.5
PLACE 1" PEEL PLY BEFORE TOP SKIN
CUT OUT FOR AILERONS
PEEL PLY
BOTTOM SKIN
BEFORE DOING BOTTOM SKIN
BL 19.5
BL 112.85
PLACE 1" WIDE X 95" LONG PEEL PLY (HOLD WITH SMALL BRADS)
8.7
6.4
T.E. OF WING (RIGHT WING)
EACH LINE ILLUSTRATES MANY STRANDS OF 'S' GLASS
EXAMPLE OF 'S' GLASS LENGTH PLACEMENT PROGRESSION UNTIL SPAR CAP TROUGH IS COMPLETELY FILLED
SPAR STUB
WING L.E.
BONDO
SKIN
PEEL PLY HELD WITH SMALL BRADS
WOOD DAM WITH GRAY TAPE ON SPAR SIDE FOR RELEASE

INSTALLING 'S' GLASS SPAR CAP (BOTTOM SIDE LEFT WING SHOWN) LAYUP ⑤

SECT A-A

SECT B-B

SECT C-C

SECT G-G

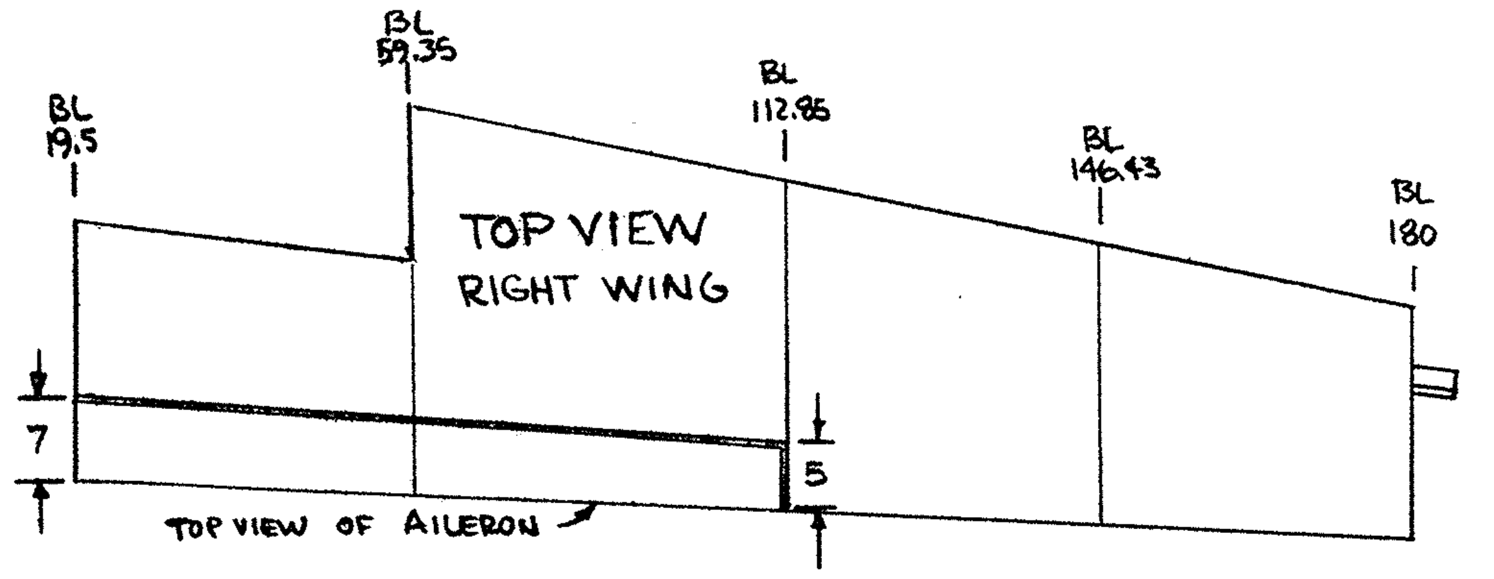
SECT D-D

SECT E-E

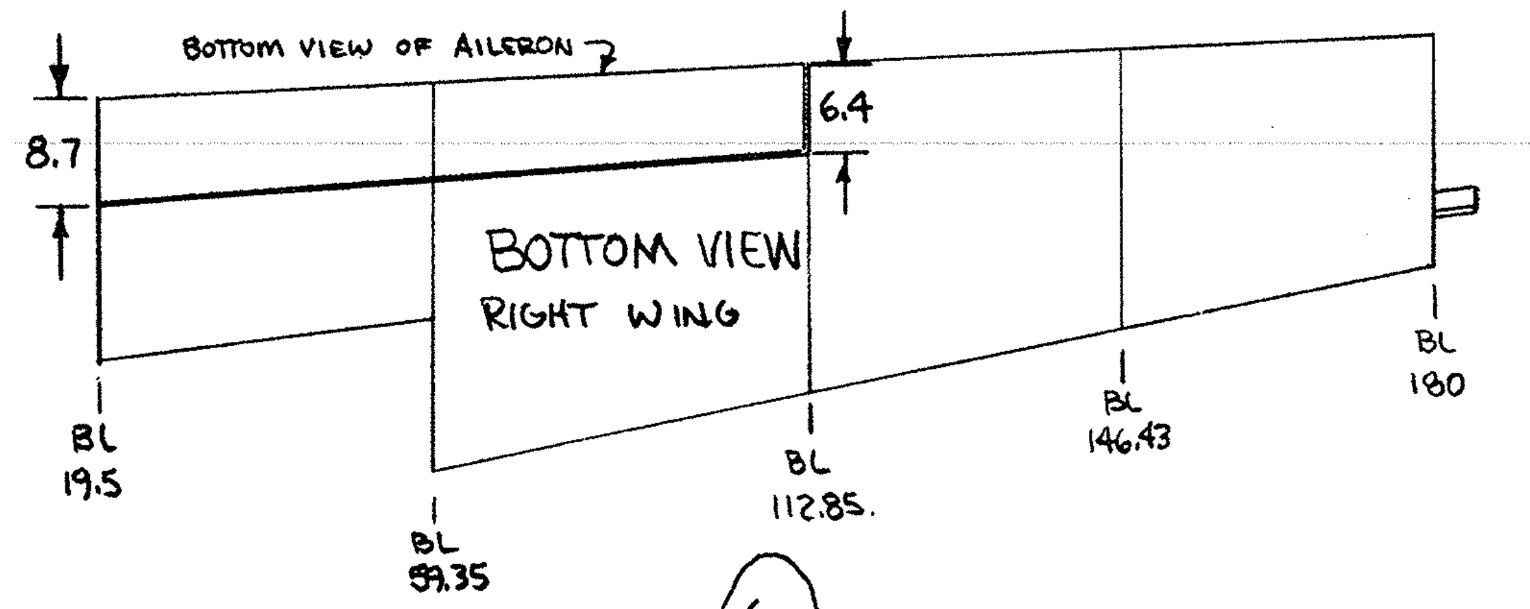
SECT F-F

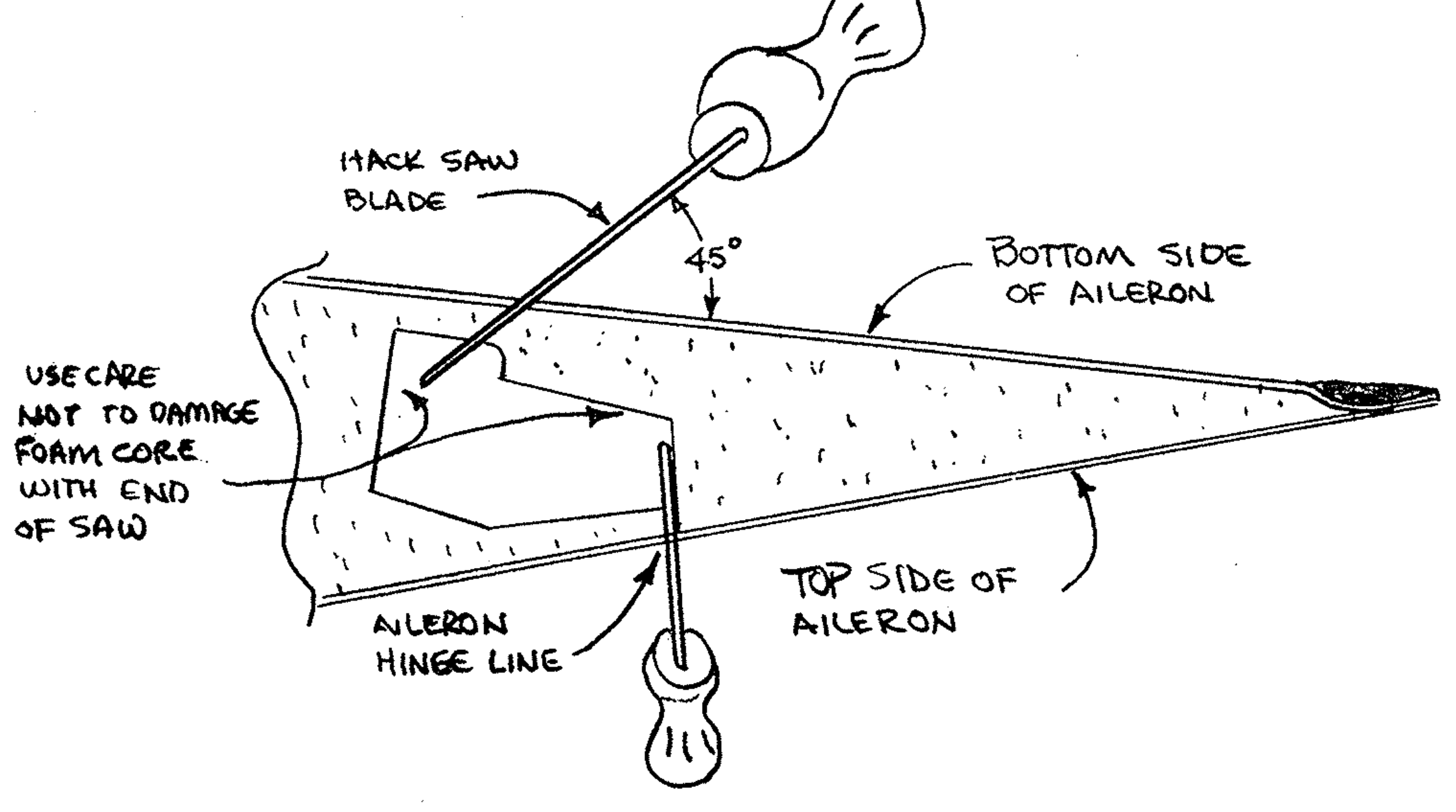
3RD PLY UND TOP SKIN - RIGHT WING

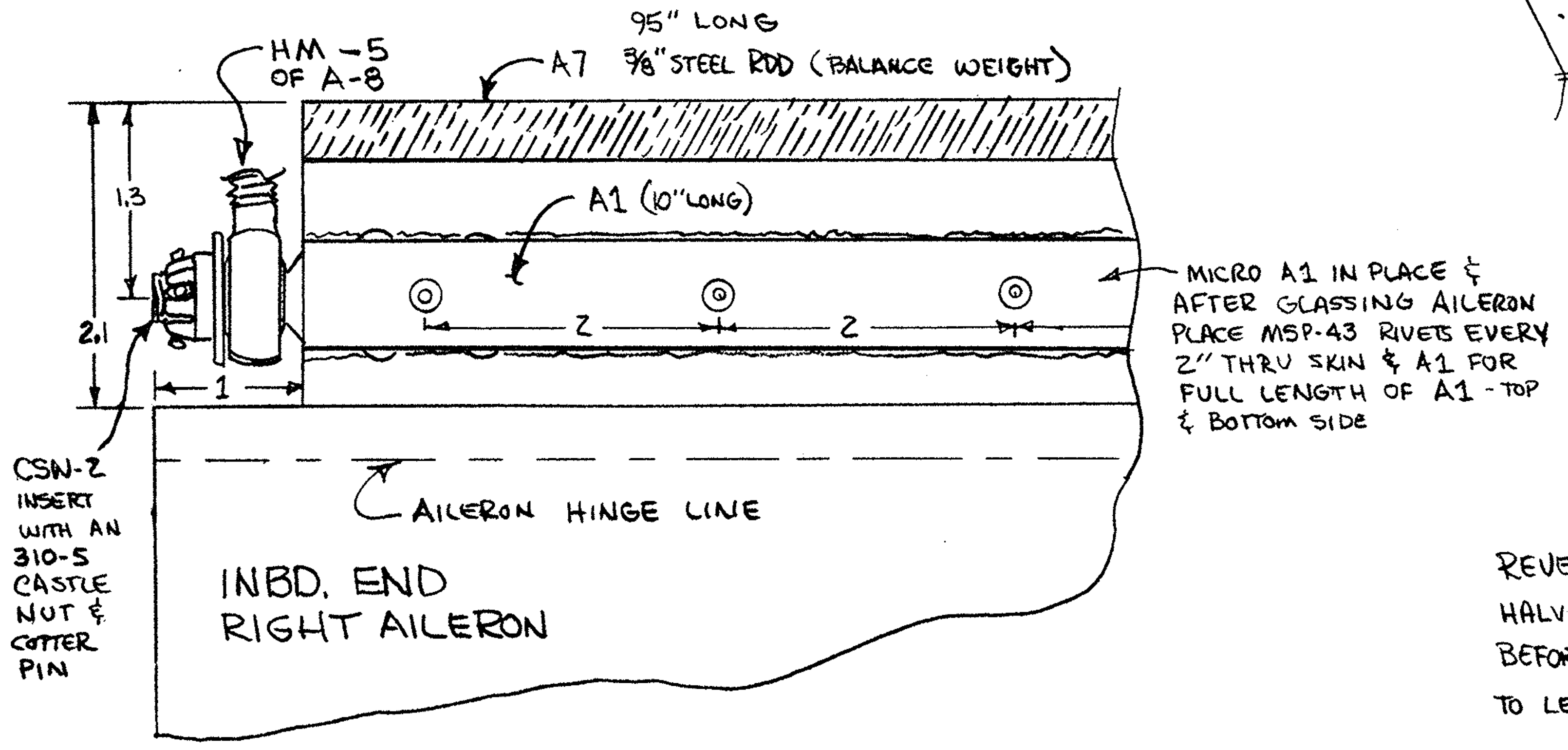
SEE PAGES C-5 & C-6

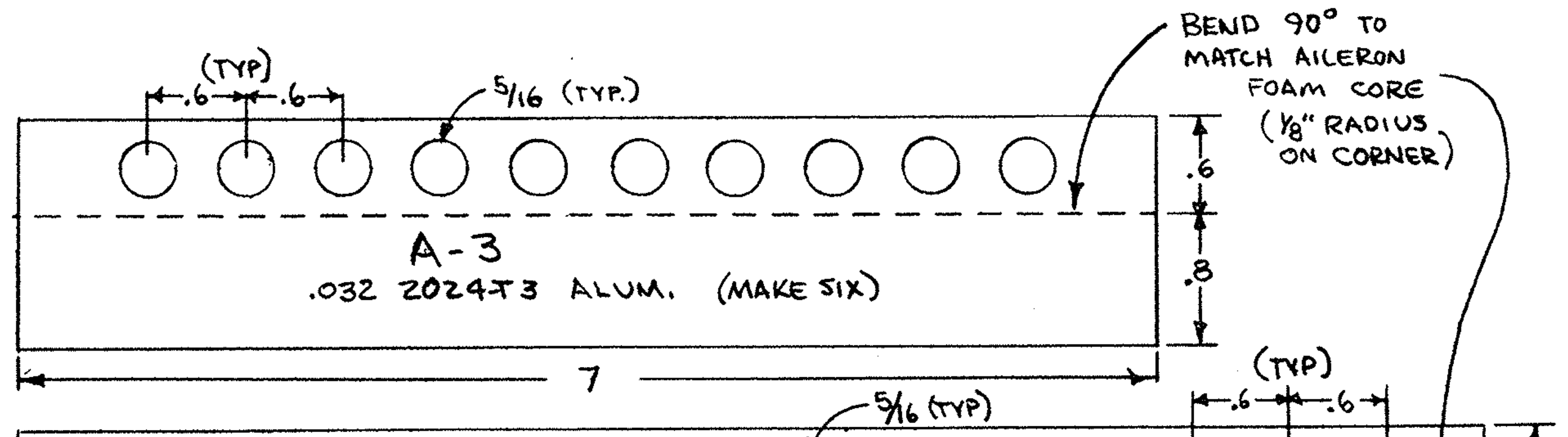


MARK STRAIGHT LINE TO DIMENSIONS SHOWN AND CUT TOP SKIN WITH HACK SAW BLADE. TURN WING OVER & AGAIN MARK STRAIGHT LINE TO DIMENSIONS SHOWN FOR BOTTOM SIDE & CUT AILERON FROM WING - NOTE: WHEN CUTTING BOTTOM SKIN SLANT HANDLE OF SAW AFT. TOWARD T.E. HOLDING AT A 45° ANGLE WHILE SAWING (SEE SKETCH BELOW)

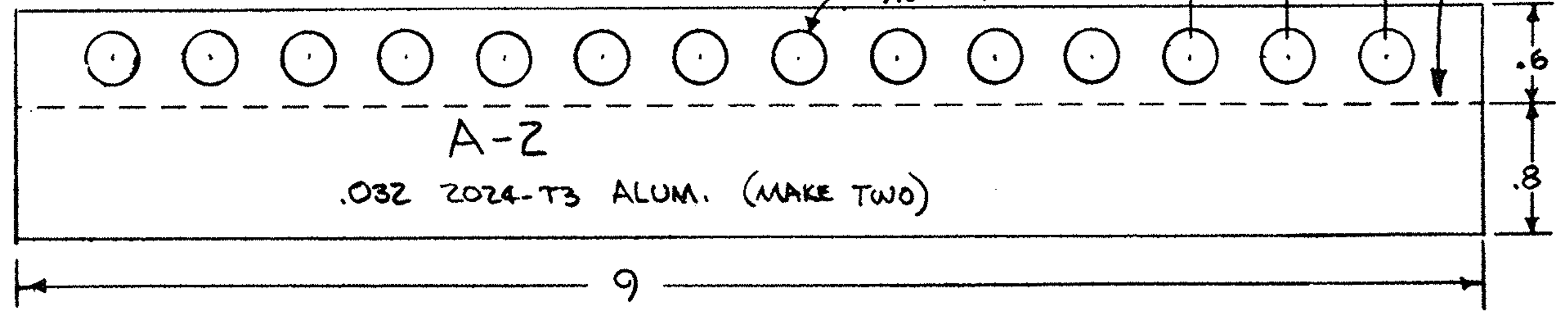




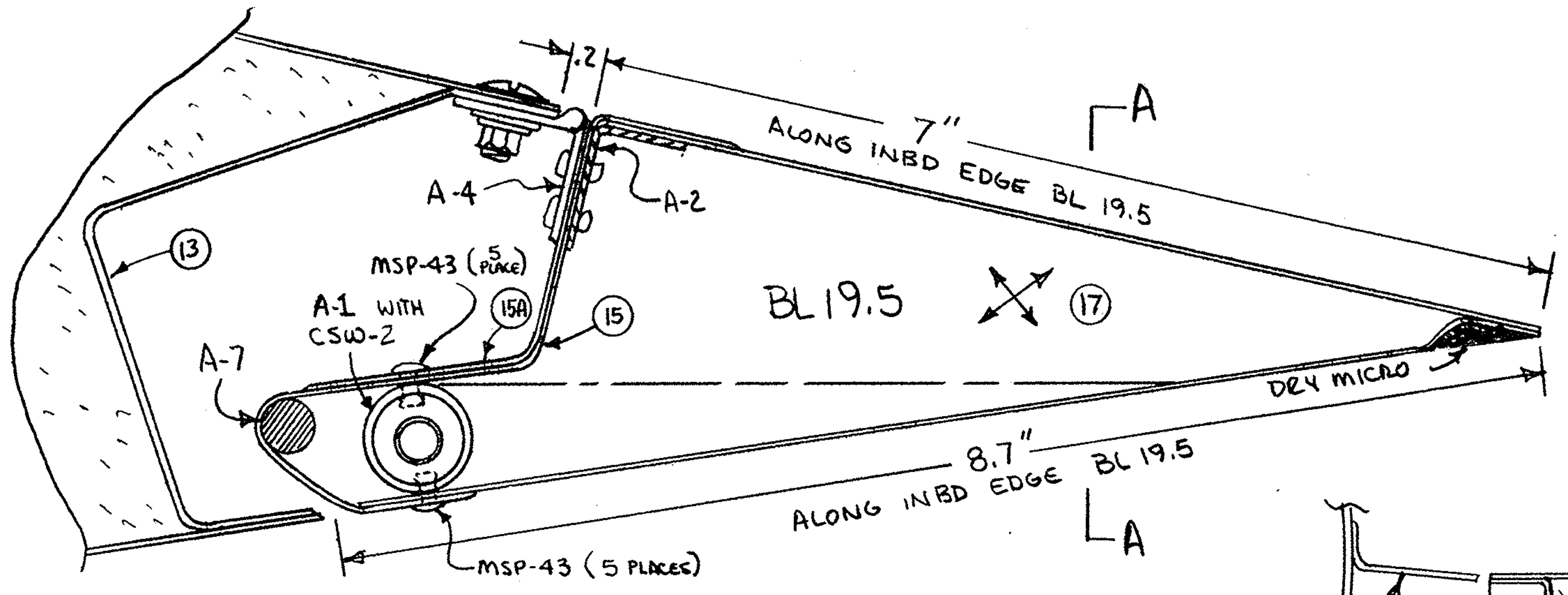

HM-5 OF A-8
95" LONG
A7 5/8" STEEL ROD (BALANCE WEIGHT)
A1 (10" LONG)
1.3
2.1
2
2
1
MICRO A1 IN PLACE & AFTER GLASSING AILERON PLACE MSP-43 RIVETS EVERY 2" THRU SKIN & A1 FOR FULL LENGTH OF A1 - TOP & BOTTOM SIDE
CSW-2 INSERT WITH AN 310-5 CASTLE NUT & COTTER PIN
AILERON HINGE LINE
INBD. END
RIGHT AILERON

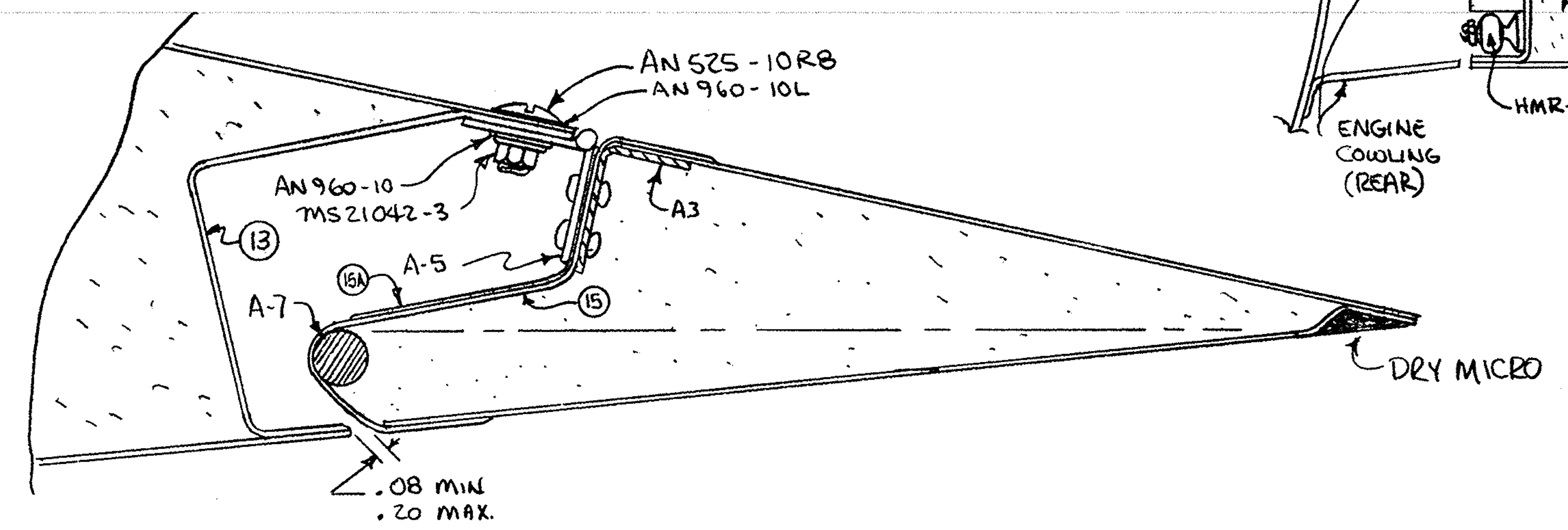


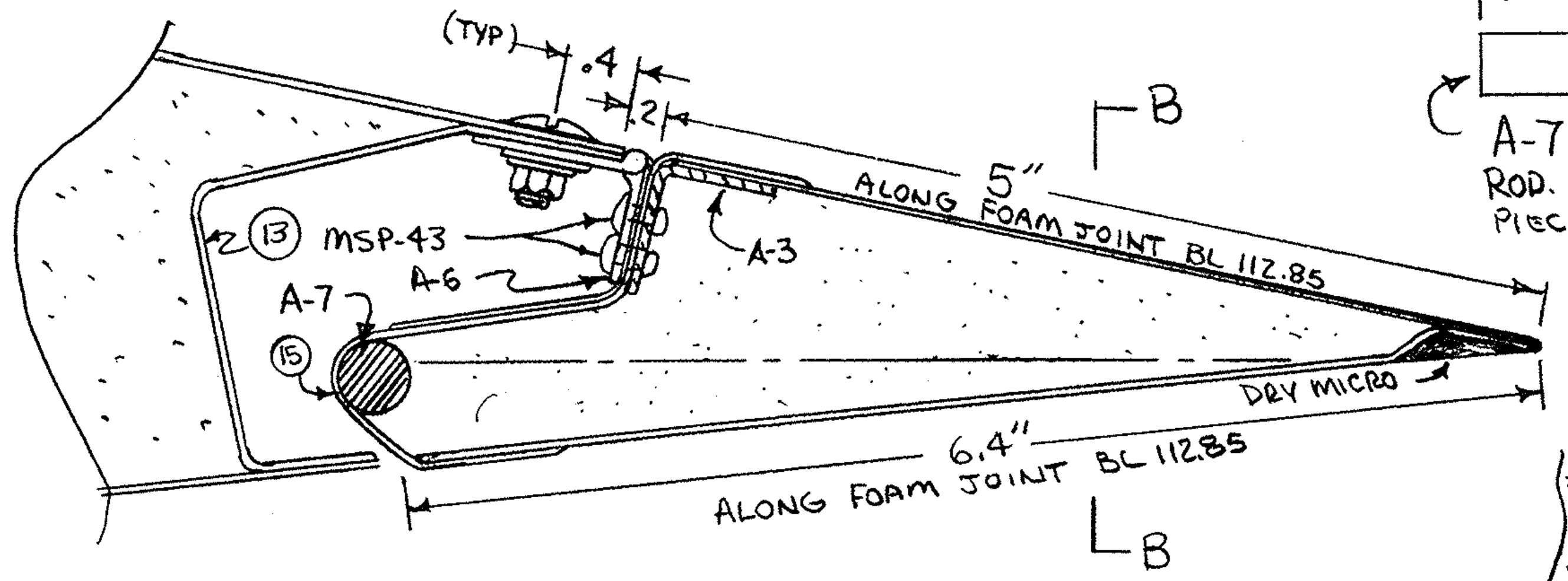
A-3
.032 2024-T3 ALUM. (MAKE SIX)

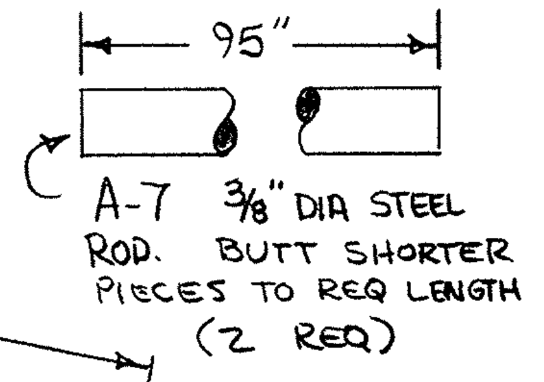


A-2
.032 2024-T3 ALUM. (MAKE TWO)

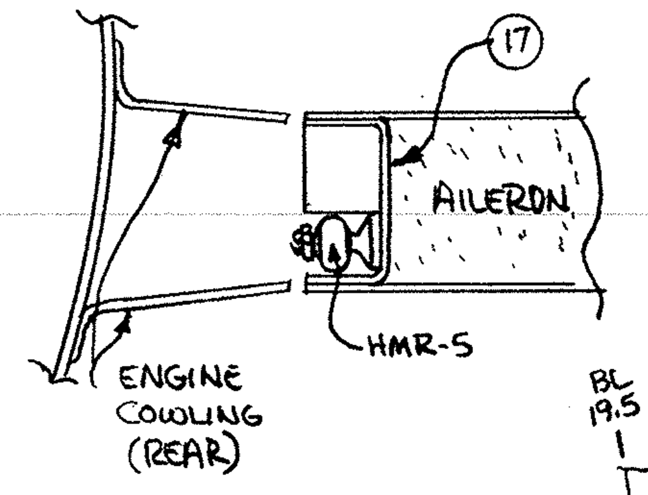




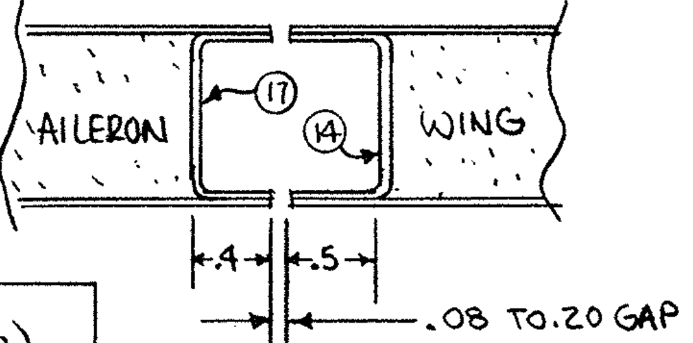


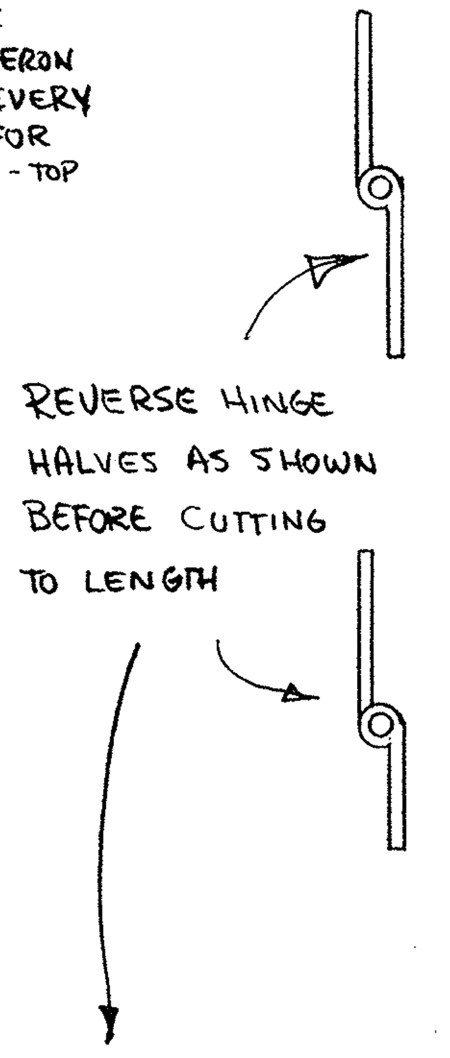


A-7 3/8" DIA STEEL ROD. BUTT SHORTER PIECES TO REQ LENGTH (2 REQ)

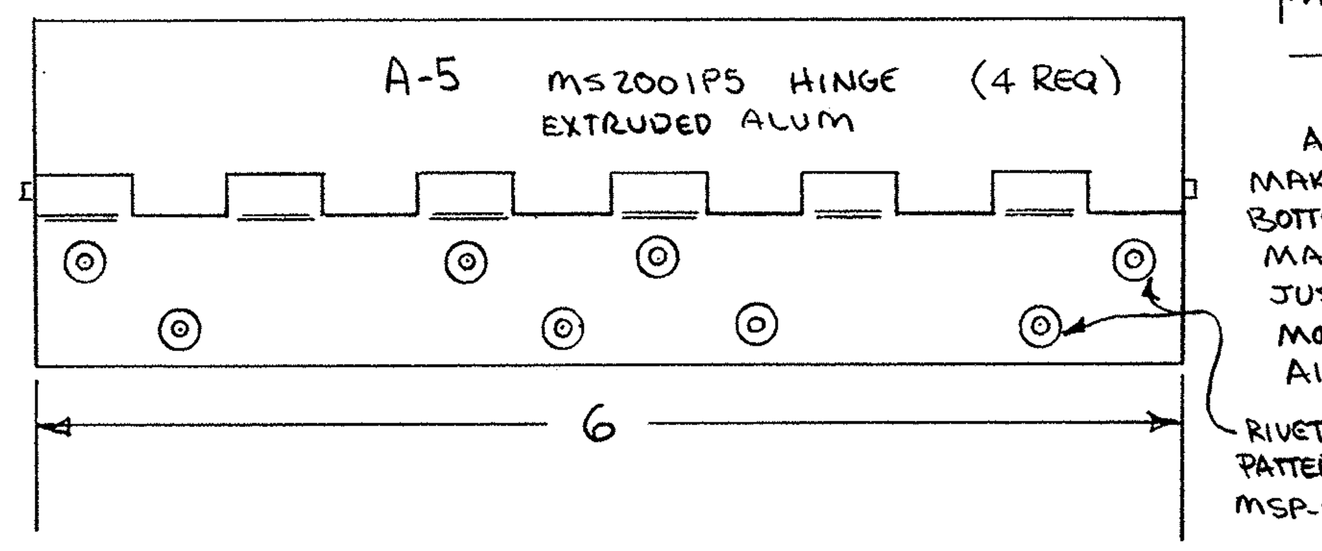


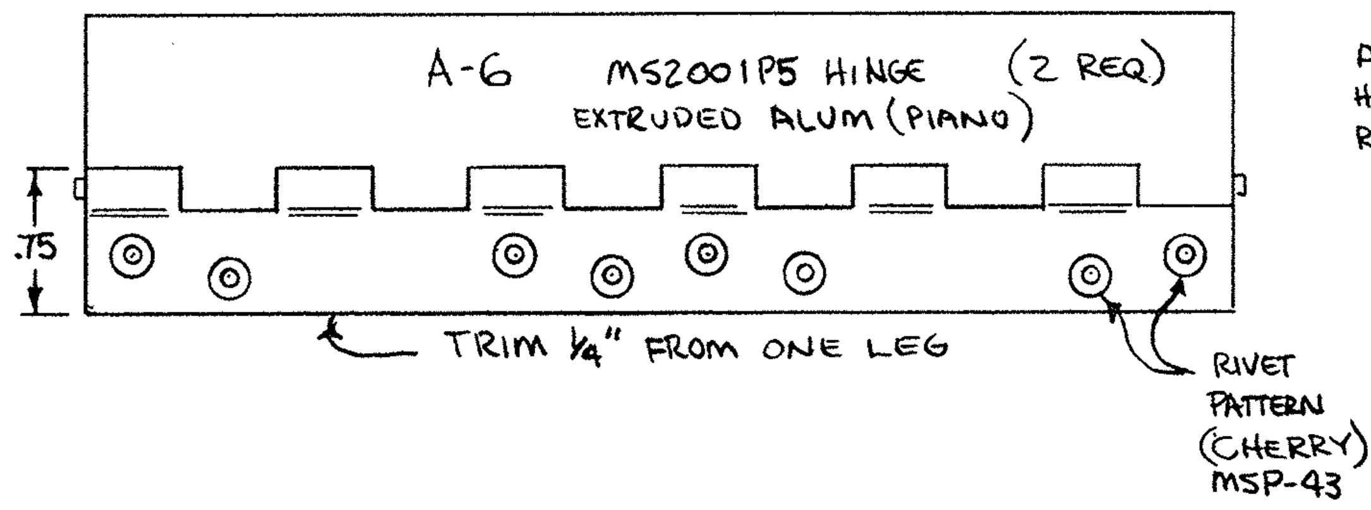
SECT B-B

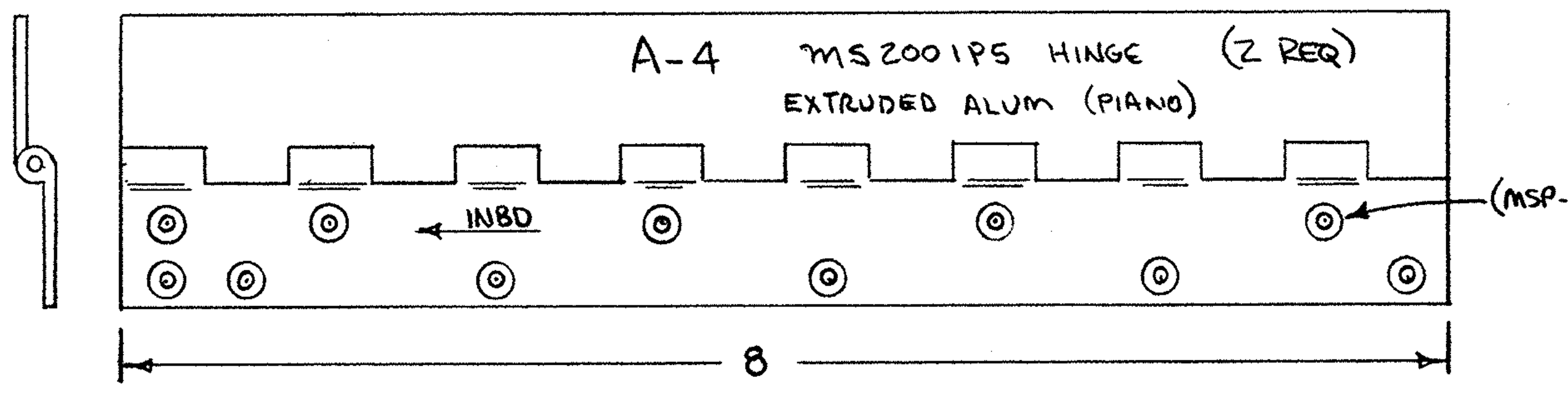


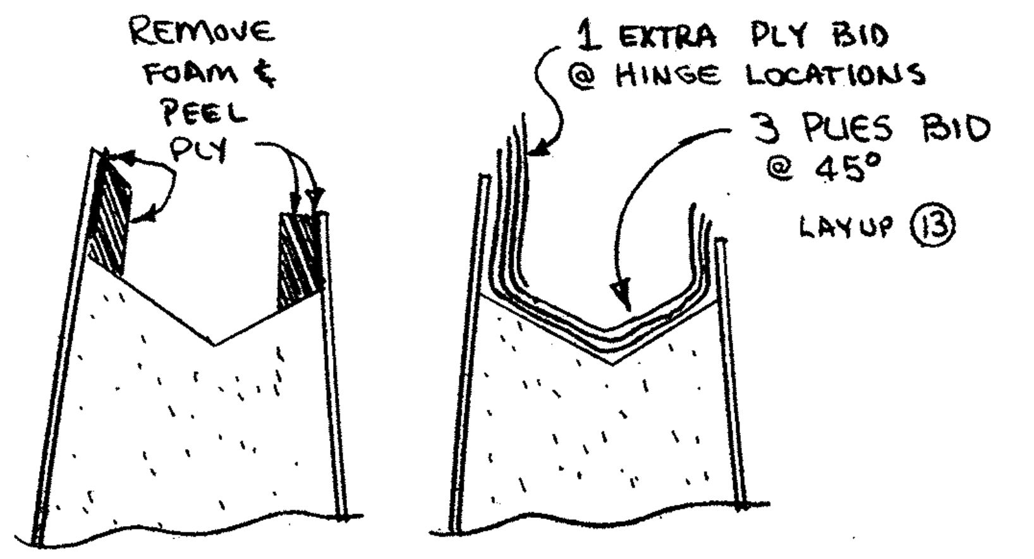


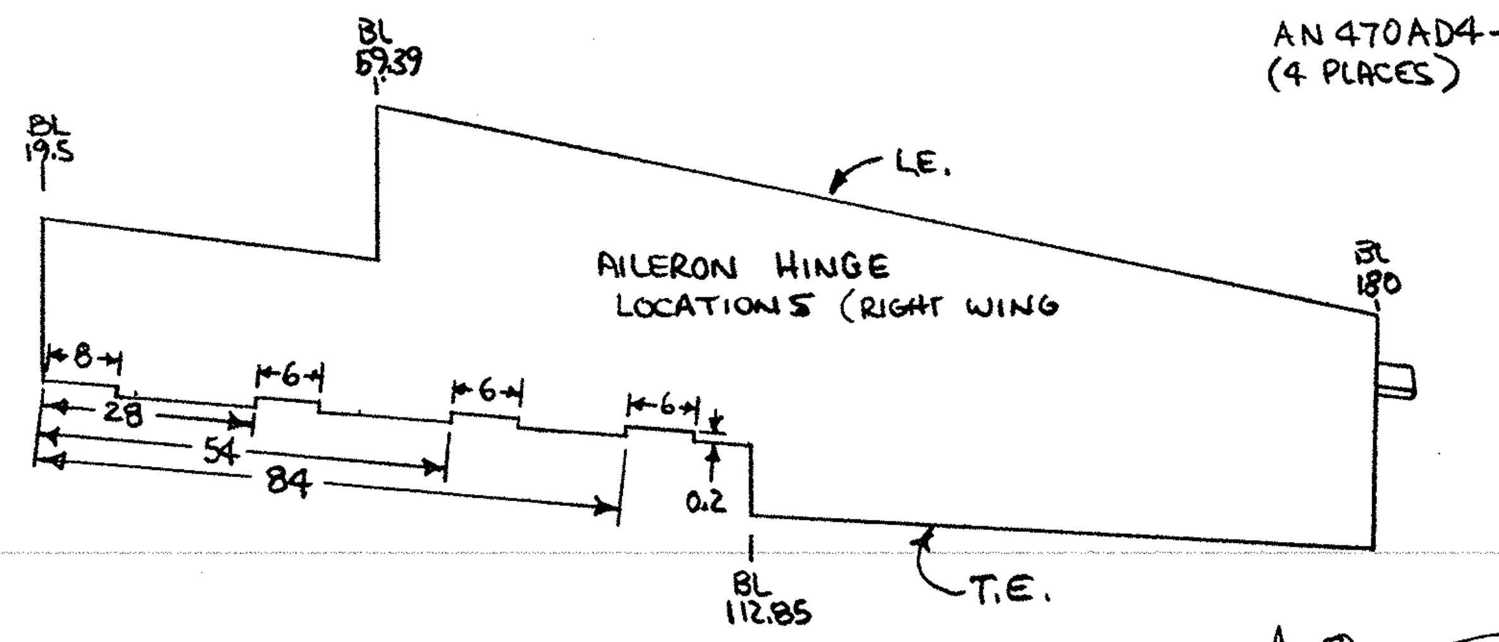
REVERSE HINGE HALVES AS SHOWN BEFORE CUTTING TO LENGTH

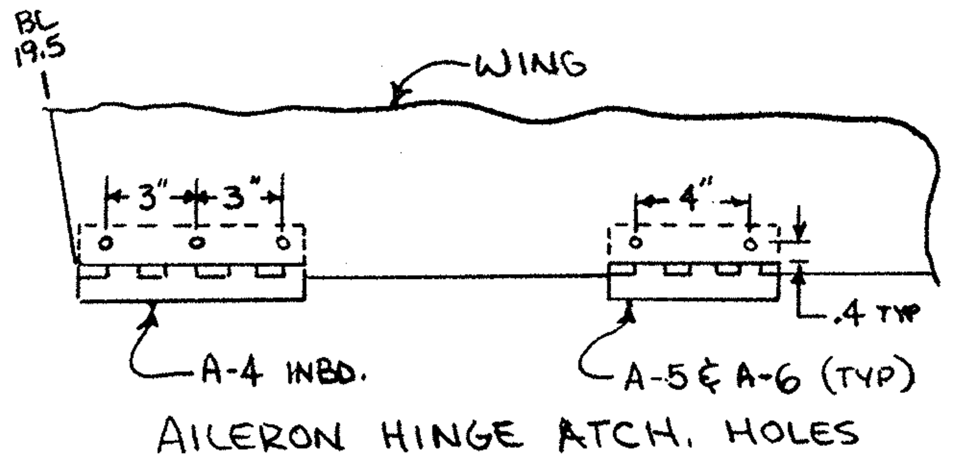




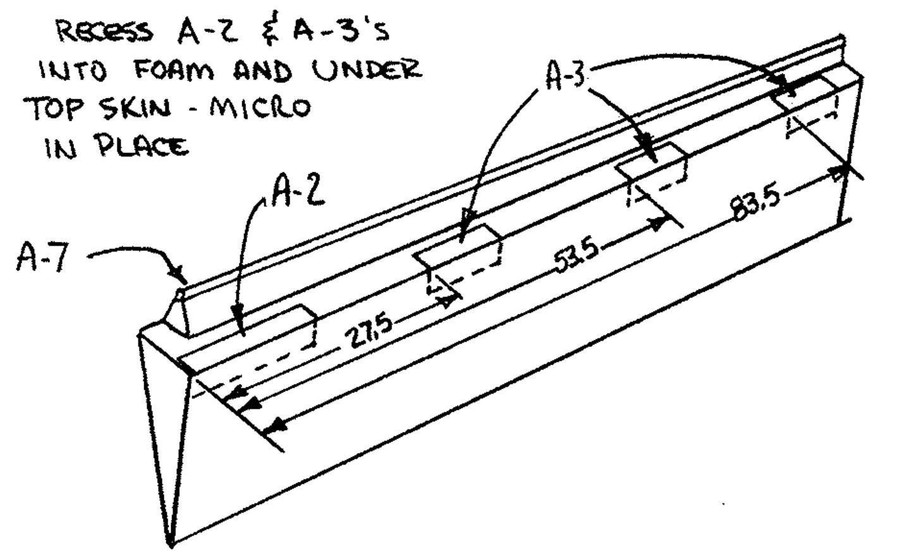


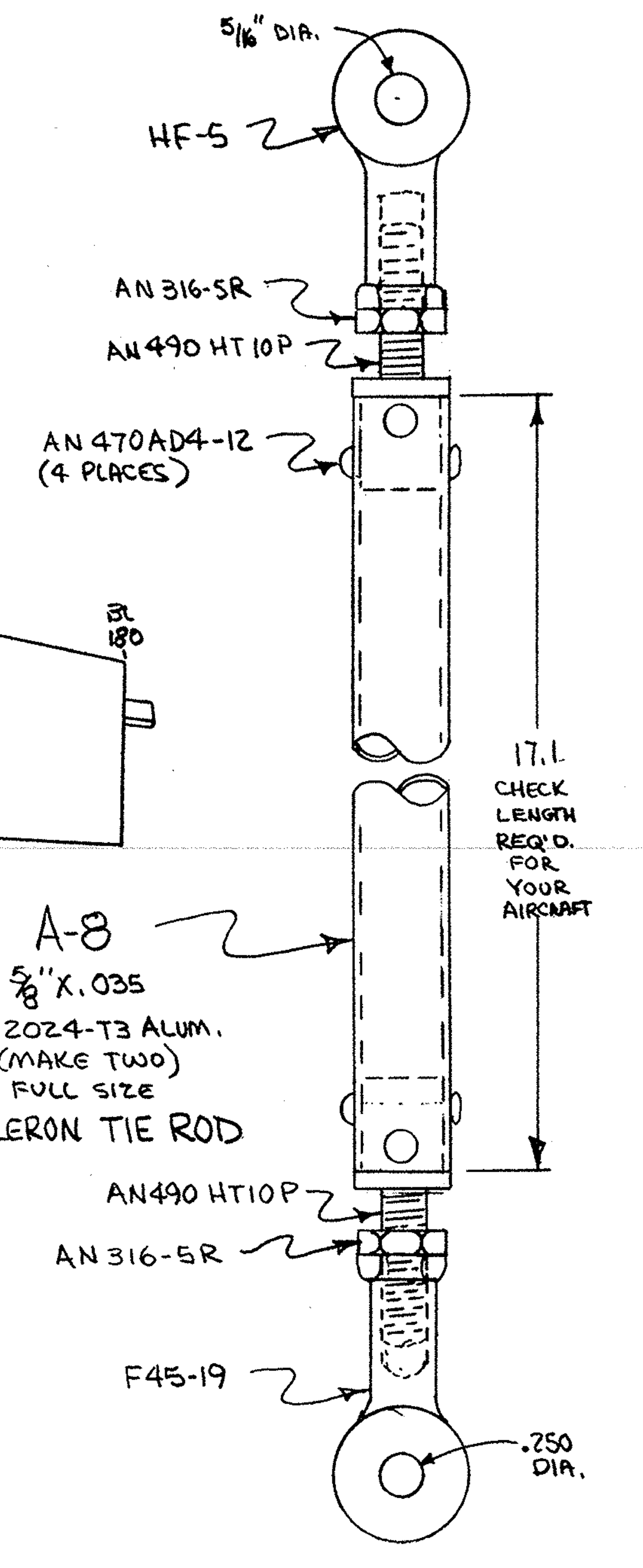






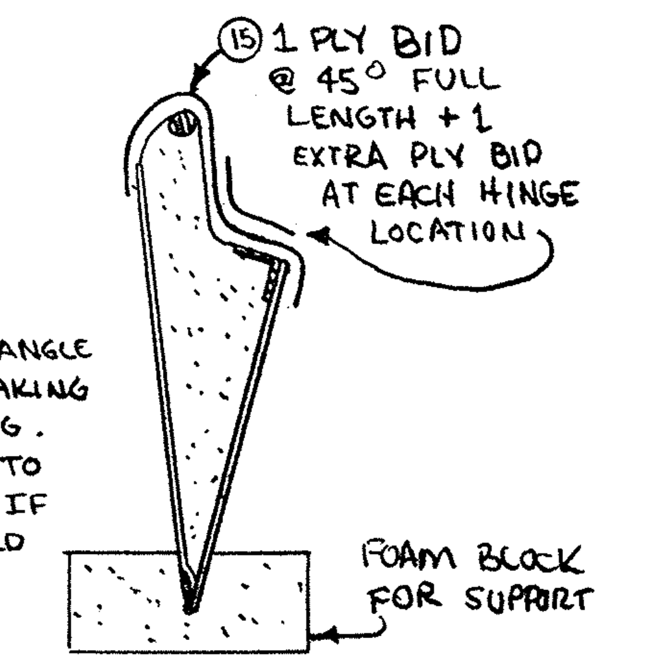
AILERON HINGE ATCH. HOLES


RECESS A-2 & A-3'S INTO FOAM AND UNDER TOP SKIN - MICRO IN PLACE
A-3
A-2
A-7
27.5
53.5
83.5

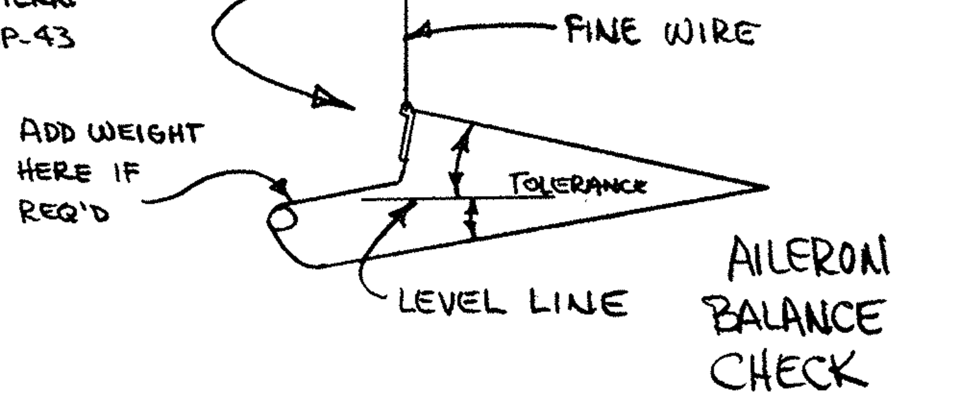


A-8 5/8" X .035 2024-T3 ALUM. (MAKE TWO) FULL SIZE

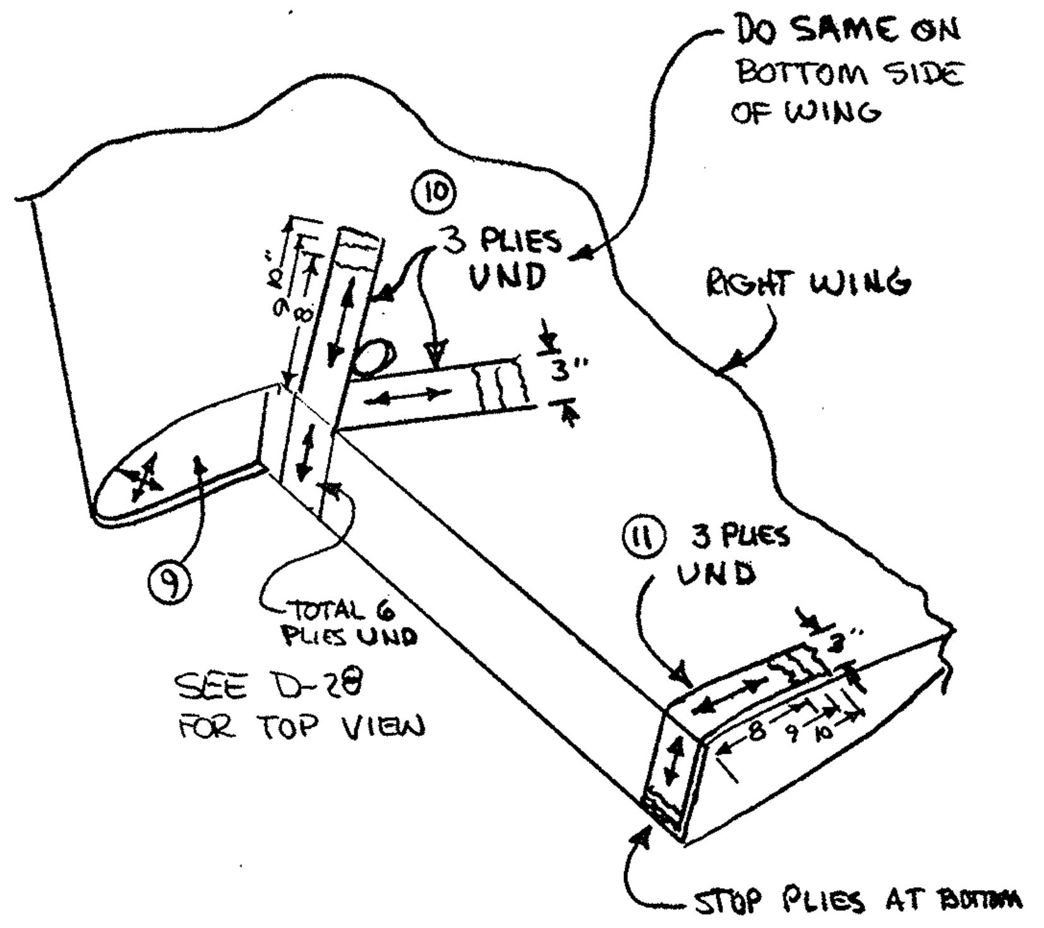
AILERON TIE ROD

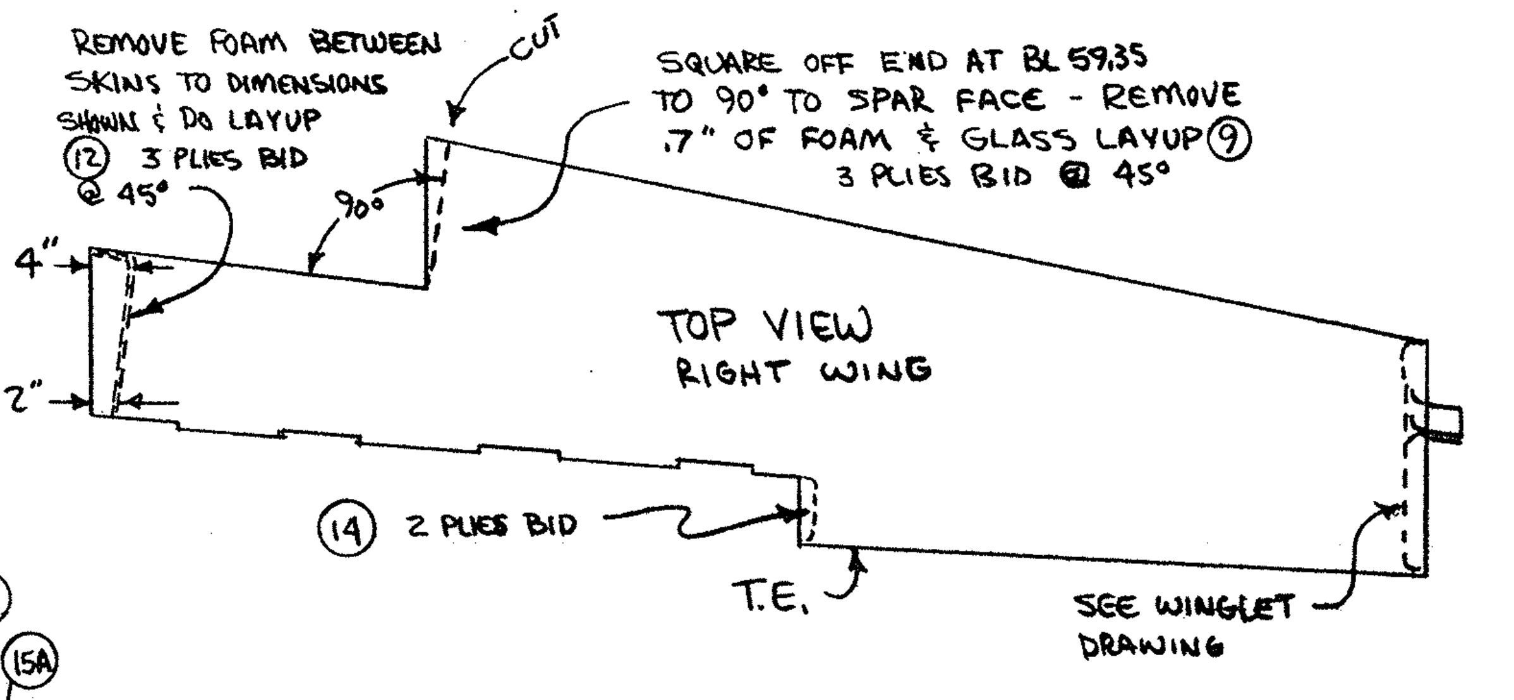

15 1 PLY BID @ 45° FULL LENGTH + 1 EXTRA PLY BID AT EACH HINGE LOCATION
FOAM BLOCK FOR SUPPORT

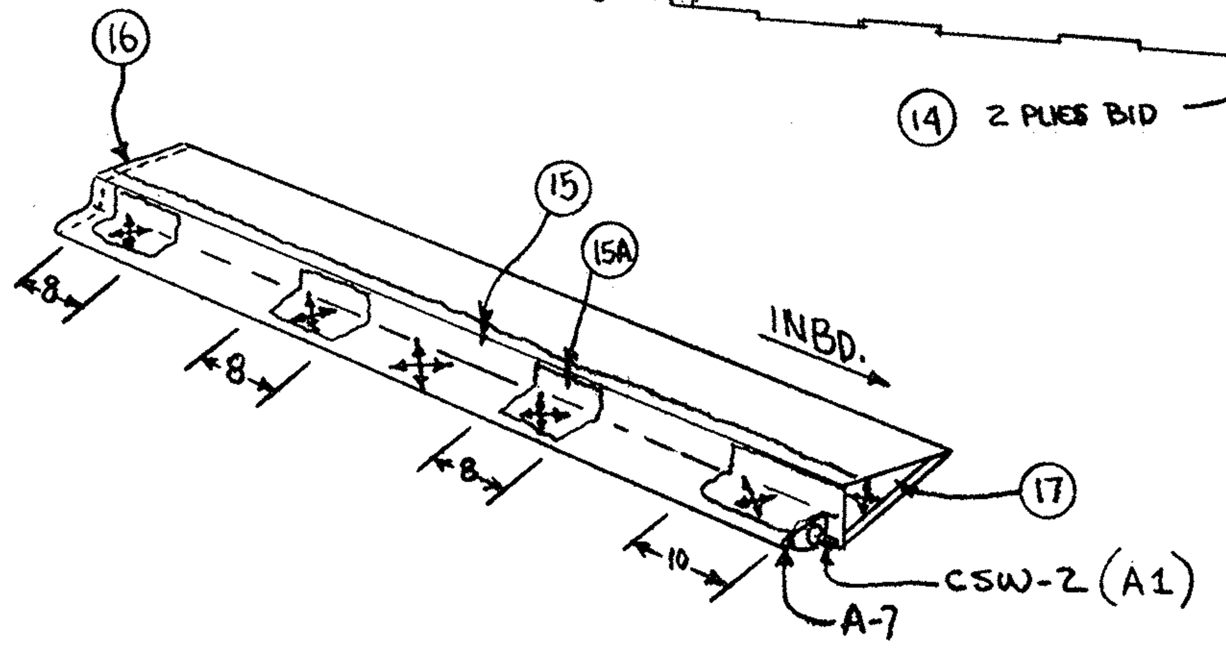
AILERON MUST HANG BETWEEN THE ANGLE MAKING TOP SKIN LEVEL & ANGLE MAKING BOTTOM SKIN LEVEL AFTER PAINTING. MAXIMUM OF .5 lb CAN BE ADDED TO JUST BEHIND A-7 TO GAIN LIMIT. IF MORE THAN .5 lb IS REQ'D. REBUILD AILERON.



AILERON BALANCE CHECK




REMOVE FOAM BETWEEN SKINS TO DIMENSIONS SHOWN & DO LAYUP 12 3 PLIES BID @ 45°
CUT
SQUARE OFF END AT BL 59.35 TO 90° TO SPAR FACE - REMOVE .7" OF FOAM & GLASS LAYUP 9 3 PLIES BID @ 45°
90°
4"
2"
TOP VIEW
RIGHT WING
14 2 PLIES BID
T.E.
SEE WINGLET DRAWING

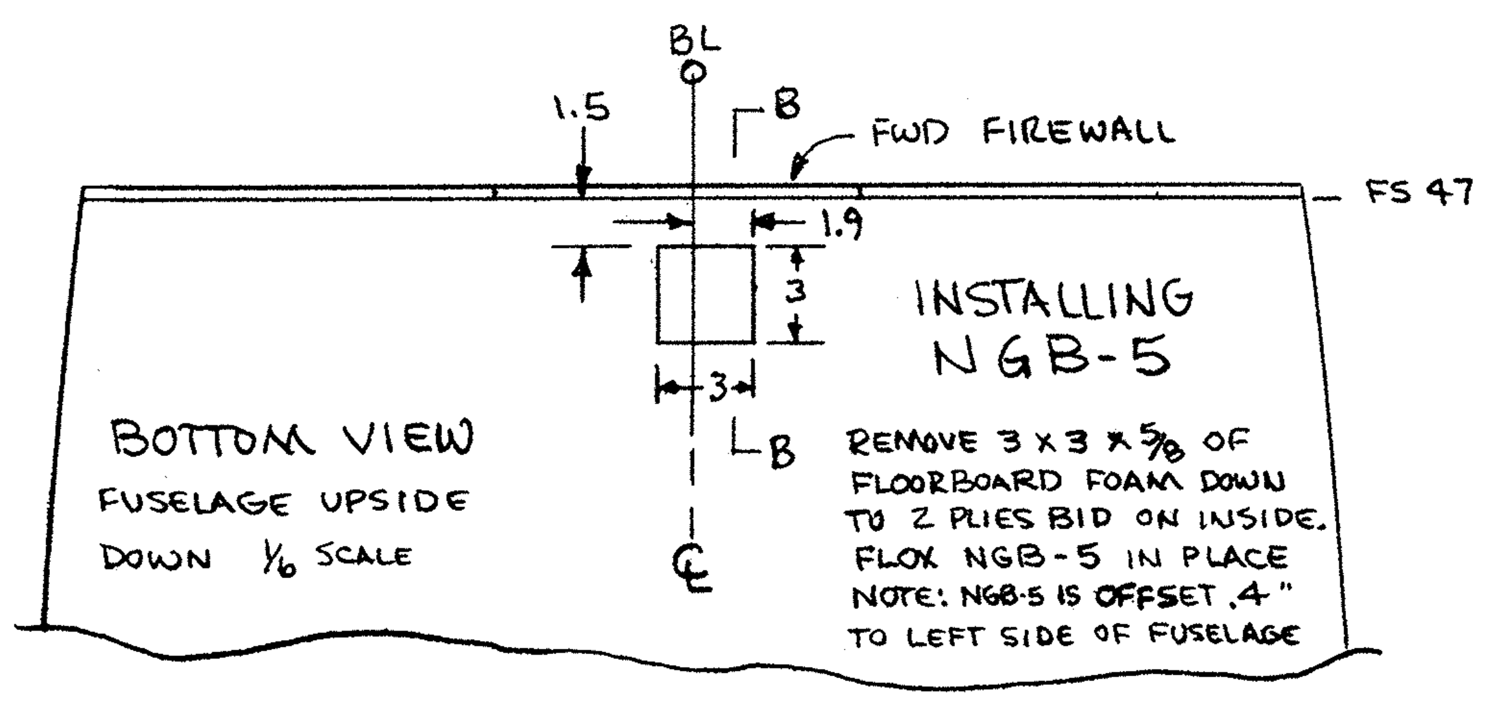


SEE PAGE C-7

BKHD. POSITIONING LAYOUT (ALL BKHDS ARE SHOWN UPSIDE DOWN) 1/5 SCALE (SIDE VIEW)
(SEE PAGES C-7 & C-8)
TRANSIT OR BUILDERS DUMPY LEVEL
ONLY HORIZONTAL ROTATION REQ.
LIETZ MOD. II OR SEARS DUMPY LEVEL
"SIGHT LINE" HORIZONTAL LEVEL LINE AS SEEN THRU BUILDERS LEVEL
WL 25 WITH RESPECT TO DIMENSIONS SHOWN
PLACE TEMP. WOOD SPACERS 8.5" LONG BTWN. BKHDS TO HOLD EXACT DIMENSION UNTIL SIDES & BOTTOM ARE PLACED.
WL 30
WL 40
WL 50
4.6
WL 29.6 LOWER ENG. MOUNT POINT
FWD. FIREWALL BKHD PG. D-9 & D-10
21.7
WL 46.7 CANARD ATCH POINT
CANARD ATCH. BKHD PG. D-11
15
F.S. 77
WL 40 REF. LINE
INSTRUMENT PANEL PG. D-12 & D-13
FWD
UP
3
WL. 28
FS 96.7
FRONT SEAT BACK PG. D-14
28.25
TOP OF FWD. SEAT BACK
FS 144.5
F.S. 153
11.5
11.5
WL 36.5
8.5
LDG. GEAR ATCH. POINT
LDG. BKHDS. PG. D-15 & D-16
30
16.5
FS 180
WL 35
WL 40
WL 41.5 LOWER ENG. MOUNT POINT
WL 45
MAIN SPAR PG. D-19
WL 50
TOP OF MAIN CARRY THRU SPAR
WL 55
AFT. FIREWALL PG. D-17
WL 60
WL 65
WL 70
FWD. FACE
FS 47
FS 57
FS 73
FS 113
FS 180
59
NOTE (A)
NOTE (B)
WORK TABLE (24" WIDE) LAID ON SIDE TO FORM STIFF BACK.
AFT FACE
FWD FACE
AFT. FACE
FWD FACE
FWD FACE
AFT FACE
FWD FACE
27
35.5
67
83.3
107
123
133
WORK SHOP FLOOR
USE TEMPLATE TO CHECK SHAPE OF FUSELAGE SIDE AS INDICATED BY DOTTED LINE
FUSELAGE SIDE TEMPLATE TO CHECK SHAPE (MAKE ONE) 1/4" PLYWOOD FULL SIZE
.7 X 1.5 SPRUCE LONGERON
1 PLY BID TAPE
1 PLY BID @ 45°
R45
TYPICAL UPPER FUSELAGE SIDE
▼▼ INDICATES OUTLINE OF BKHDS
BL-0
LONGERON
CANARD MT.
16
48
17.2
45.8
UPPER ENG. MT.
OUTLINE OF BRL-1
WL 50
WL 40
PG. D-9 & D-10
UP
LEFT
(MICRO BKHD TO SIDES & BOTTOM)
5/8 R45 FOAM BUTTS ONTO AFT FACE OF FWD. FIREWALL
15.5
ENG. MT.
29.6
PG. D-11
(MICRO SIDES TO BKHD)
5/8 R45 FOAM PLACED AGAINST CANARD BKHD.
PG. D-12 & D-13
5/8 R45 FOAM (MICRO) PLACED AGAINST INSTRUMENT PANEL BKHD.
PG. D-14
(MICRO SIDE TO BKHD)
5/8 R45 FOAM PLACED AGAINST FRONT SEAT BKHD
PG. D-15 & D-16
5/8 R45 PLACED AGAINST BOTH LDG. GEAR BKHDS
▲▲ THESE MARKS INDICATE OUTLINE OF BULKHEADS
WL 70
WL 60
3/8 R45 TURTLE DECK
16.5
ENG. MT.
59.25
PG. D-17
(MICRO FOAM TO BKHD)
5/8 R45 FOAM BUTTS ONTO FWD. OF AFT FIREWALL
14.7
41.5
1 PLY BID @ 45°
TYPICAL LOWER JOINT
2" WIDE 1 PLY BID TAPE @ 45°
1-PLY BID @ 45°
SHAPE FUSELAGE CORNER AS INDICATED BY DOTTED LINE
R 45

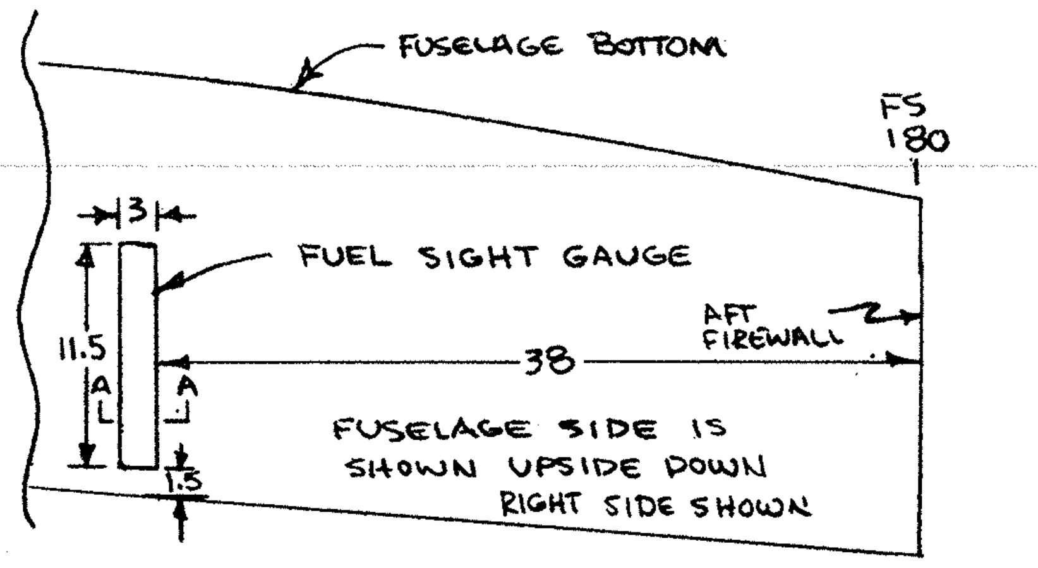
NOTE A & B

THESE DIMENSIONS ARE WITH RESPECT TO HEIGTH OF TABLE (STIFF BACK) USED TO ATTACH 1"x2" STICKS WHICH HOLD BKHDS. IN PLACE. WORK TABLE IS 24" WIDE AND WHEN LAID ON ITS SIDE MAKES STIFF BACK 24" HIGH. IF DIMENSION (B) IS 24" THEN (A) BECOMES 35" DO NOT MEASURE ELEVATION OF BKHDS FROM STIFF BACK - USE BUILDERS LEVEL PROCESS ONLY

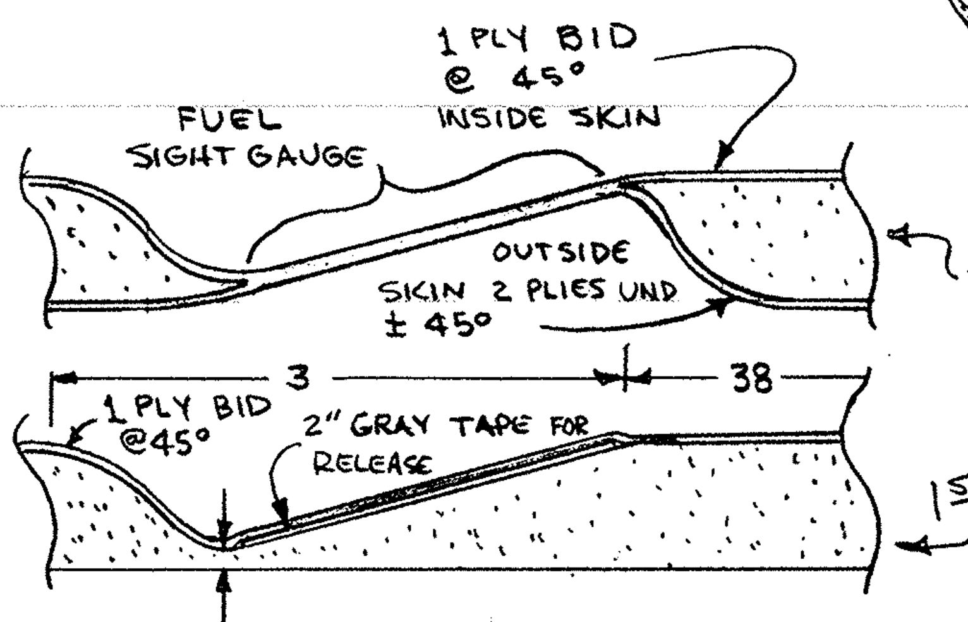


INSTALLING NGB-5

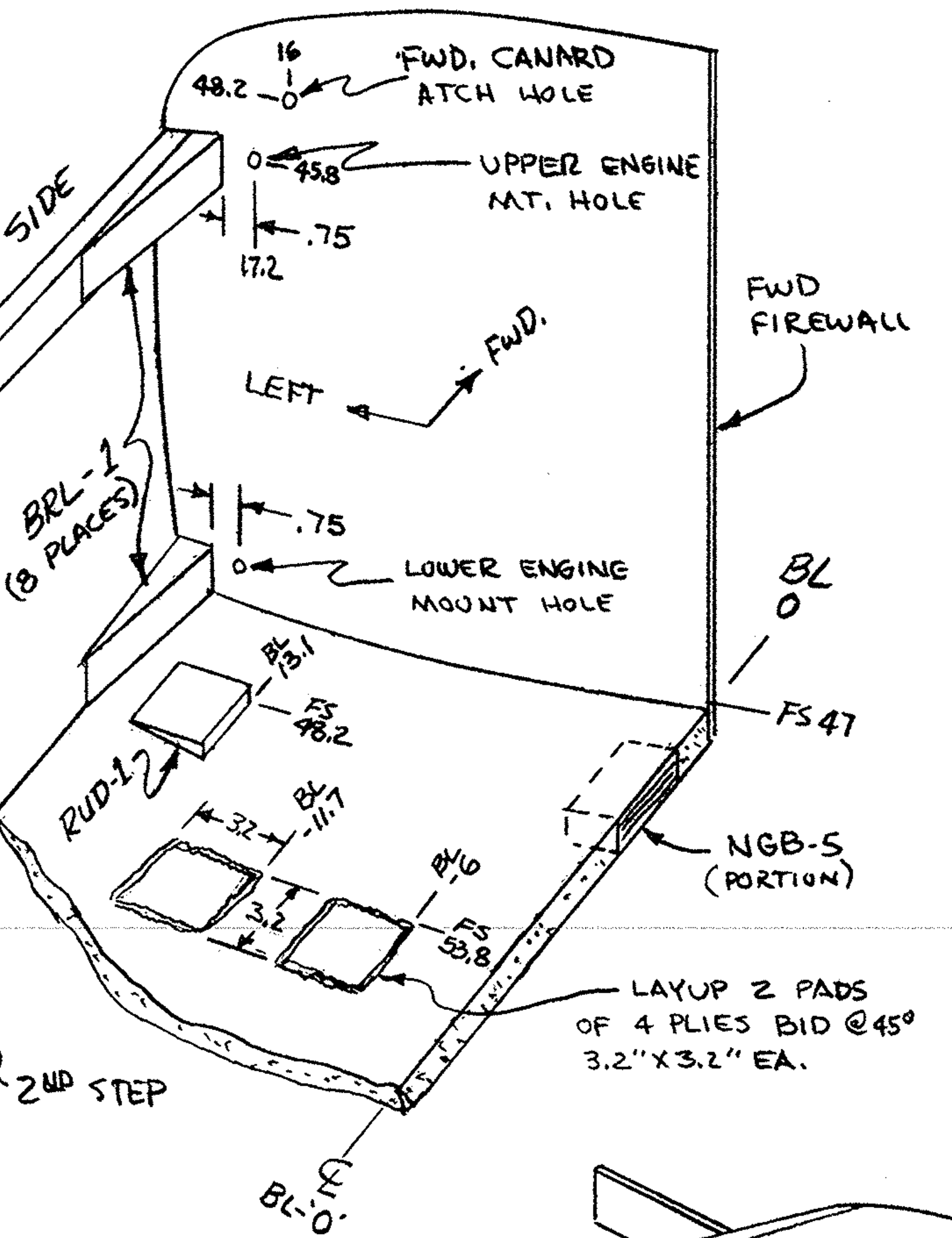
REMOVE 3 X 3 X 5/8 OF FLOORBOARD FOAM DOWN TO 2 PLIES BID ON INSIDE. FLOX NGB-5 IN PLACE NOTE: NGB-5 IS OFFSET .4" TO LEFT SIDE OF FUSELAGE



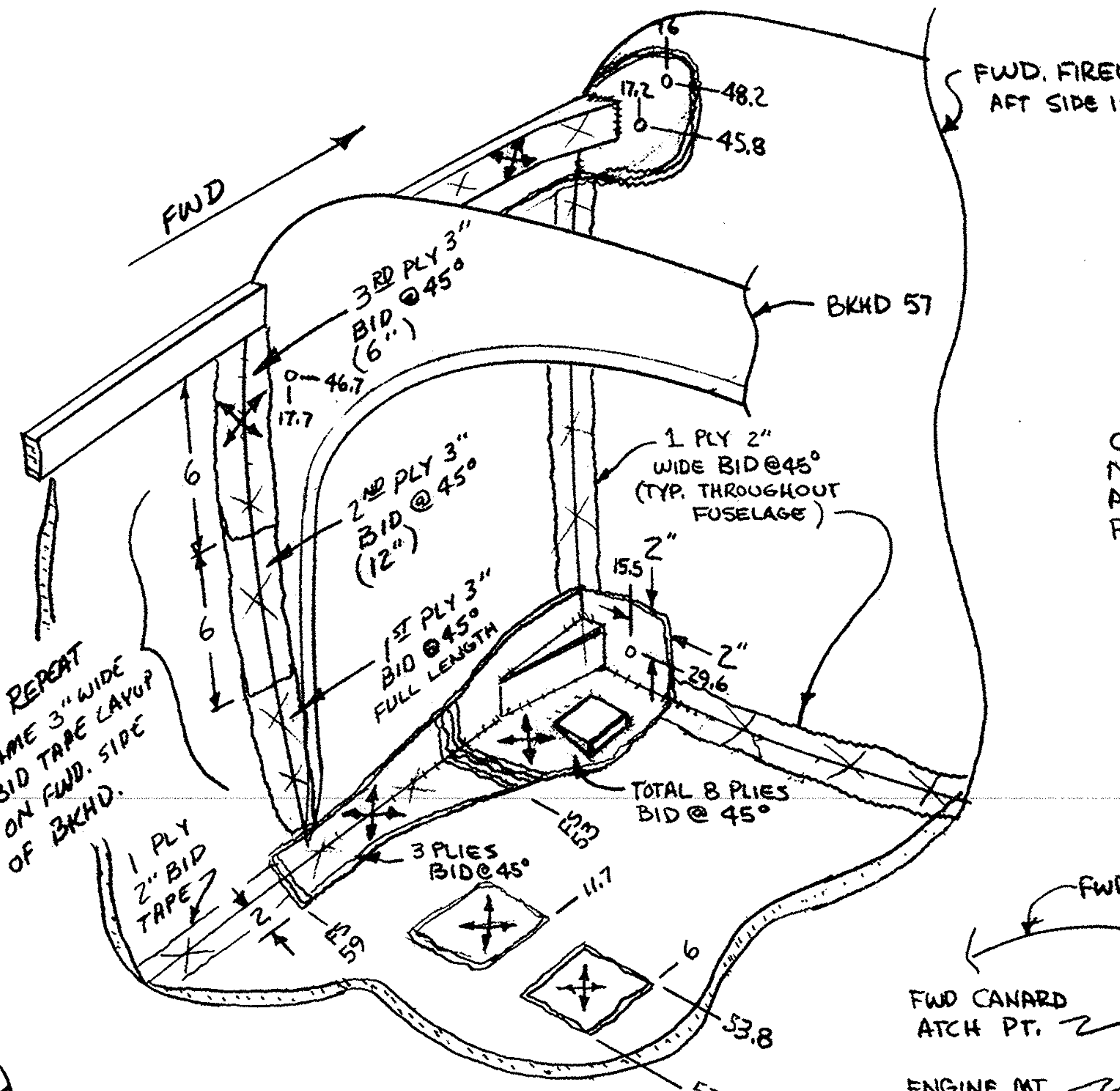
SIGHT GAUGE IS PARALLEL TO AFT FIREWALL

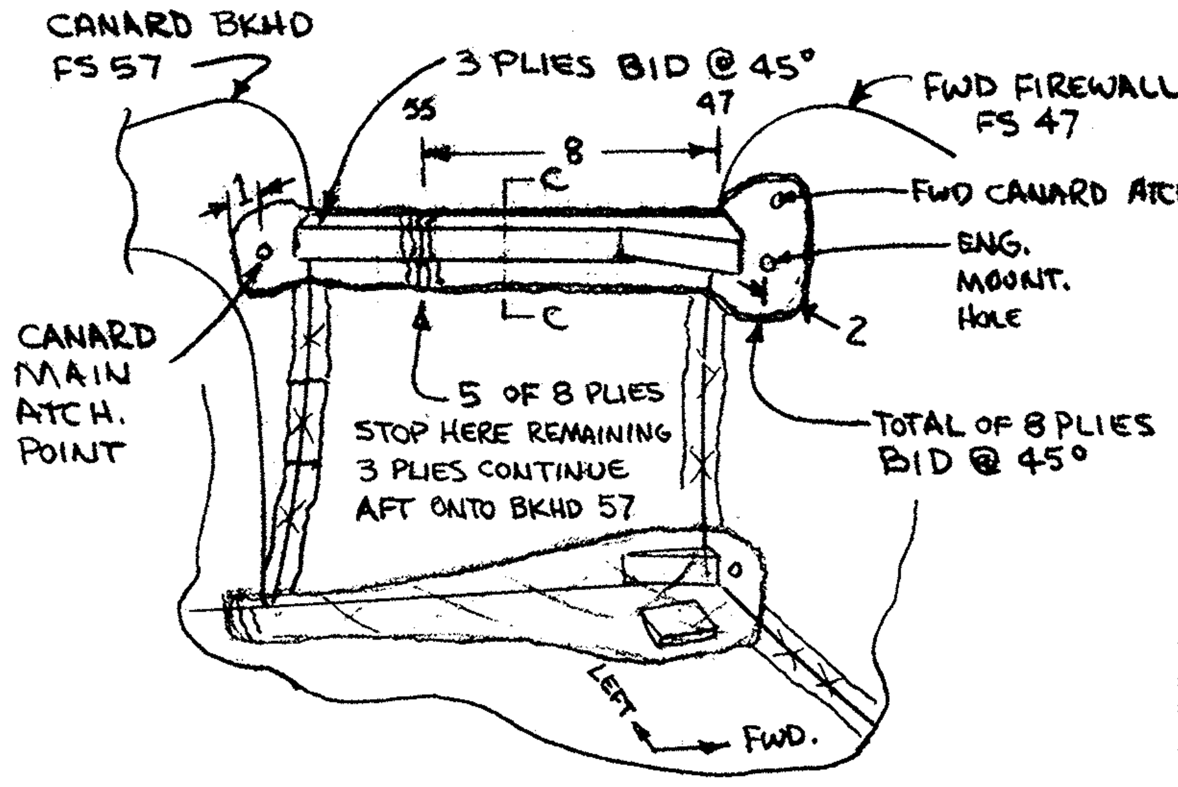


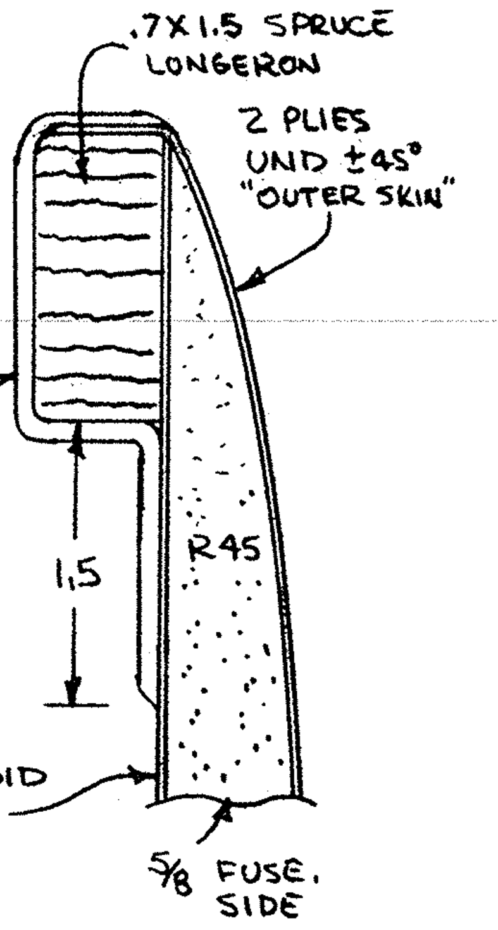
SECT A-A



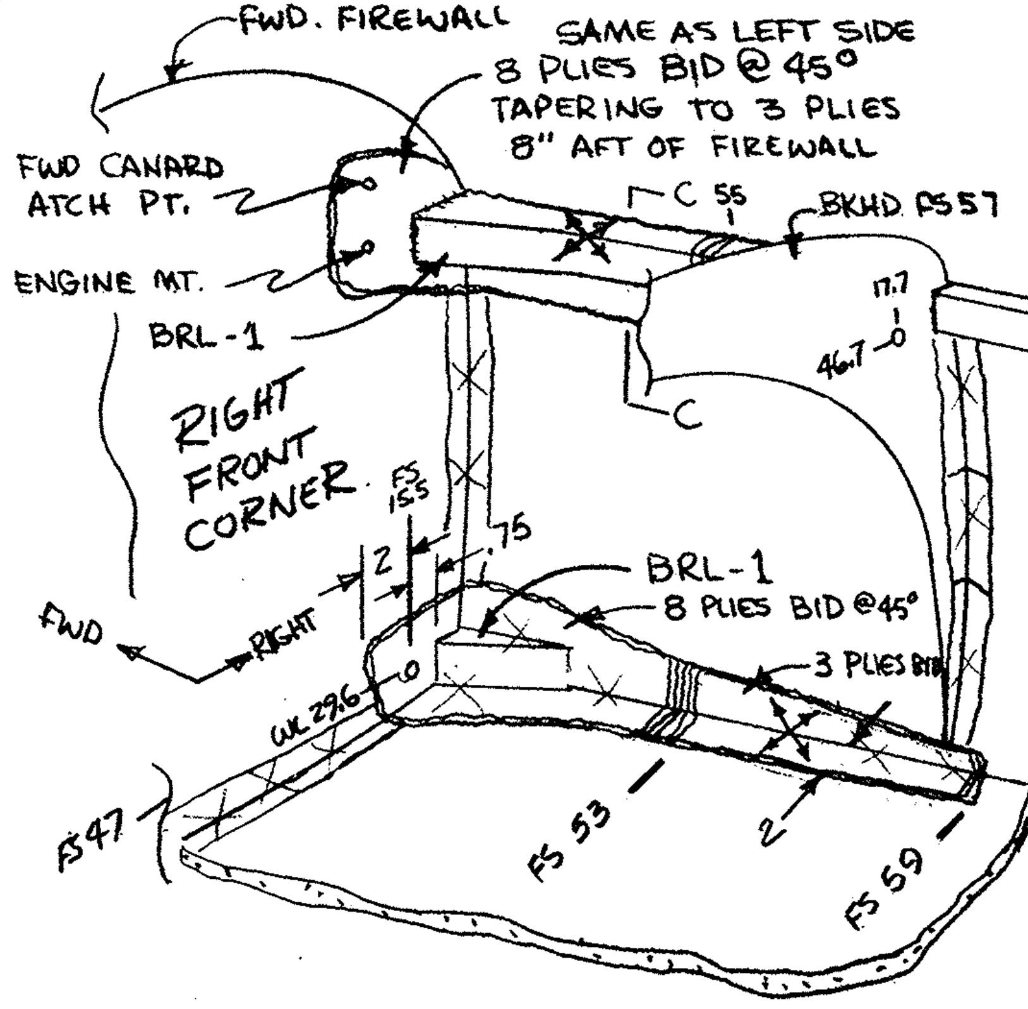
LEFT FRONT CORNER

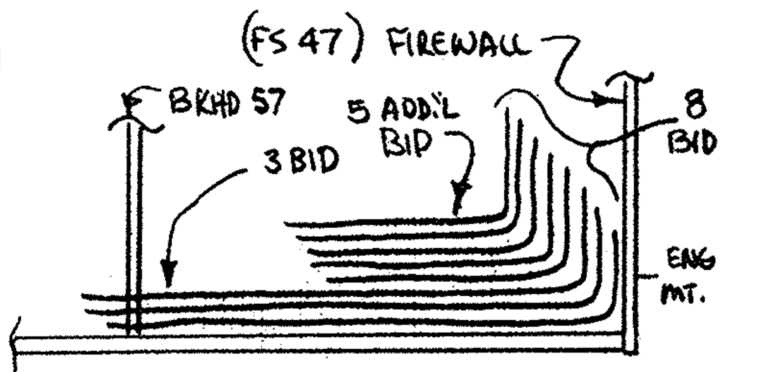

16
17.2
48.2
45.8
FWD. FIREWALL AFT SIDE IS FS 47
FWD
3RD PLY 3" BID @45° (6")
46.7
17.7
BKHD 57
6
6
2ND PLY 3" BID @ 45° (12")
1ST PLY 3" BID @45° FULL LENGTH
1 PLY 2" WIDE BID @45° (TYP. THROUGHOUT FUSELAGE)
15.5
2"
2"
29.6
REPEAT SAME 3" WIDE BID TAPE LAYUP ON FWD. SIDE OF BKHD.
1 PLY 2" BID TAPE
2
FS 59
3 PLIES BID@45°
FS 53
TOTAL 8 PLIES BID @ 45°
11.7
6
53.8
57



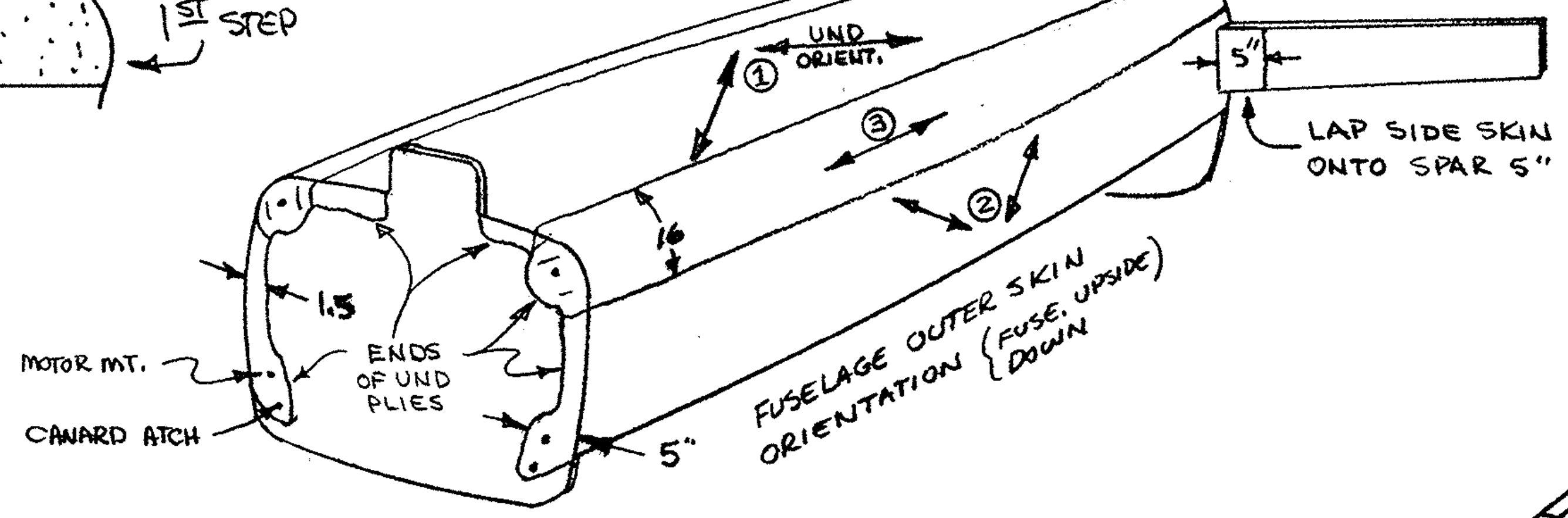

.7X1.5 SPRUCE LONGERON
2 PLIES UND ±45° "OUTER SKIN"
8 PLIES BID @ 45° TAPERING TO 3 PLIES 8" AFT OF FIREWALL
1.5
R45
1 PLY BID @ 45°
5/8 FUSE. SIDE

SECT. C-C



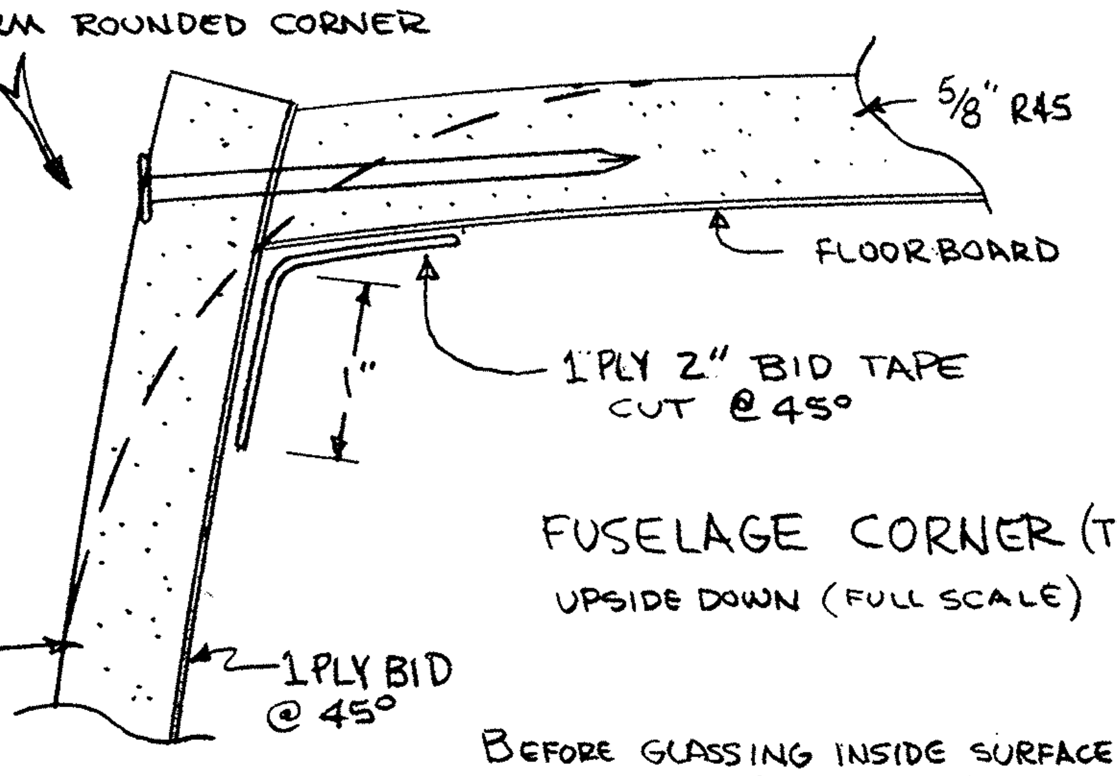


TYPICAL 8 PLIES BID @ 45° AT EACH MOTOR MT. LOCATION


UND ORIENT.
①
③
②
16
5"
LAP SIDE SKIN ONTO SPAR 5"
1.5
ENDS OF UND PLIES
MOTOR MT.
CANARD ATCH
5"
FUSELAGE OUTER SKIN ORIENTATION (FUSE. UPSIDE DOWN)

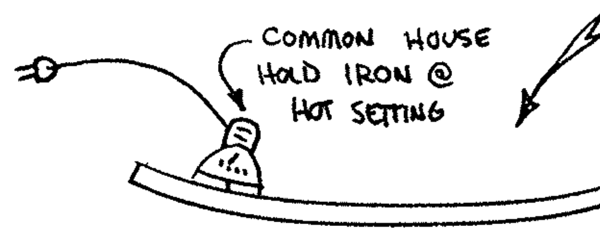
SEE PAGE C-8

AFTER TAPE HAS CURED REMOVE NAIL AND FOAM TO FORM ROUNDED CORNER

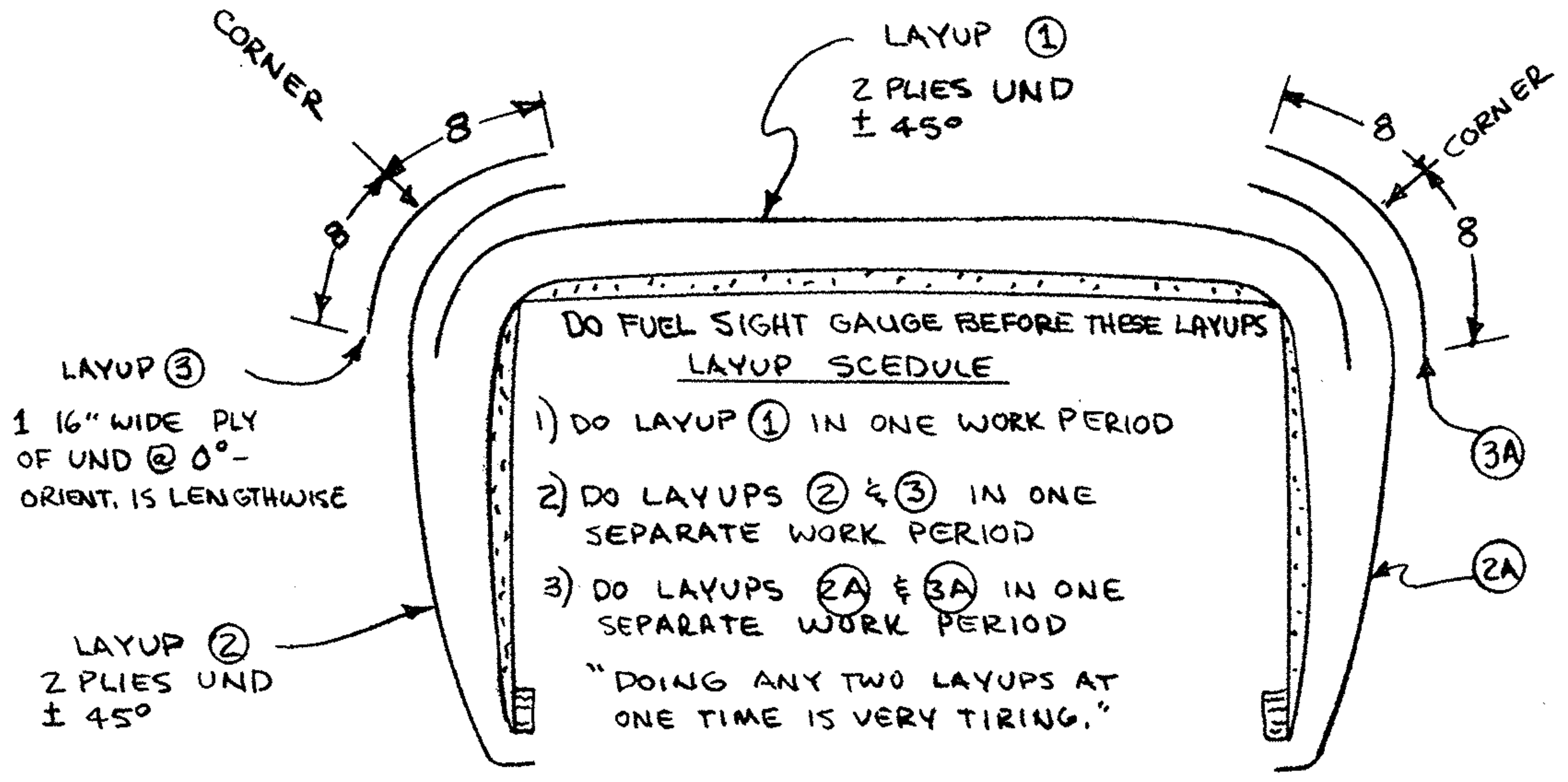


FUSELAGE CORNER (TYP.)

UPSIDE DOWN (FULL SCALE)


COMMON HOUSE HOLD IRON @ HOT SETTING

BEFORE GLASSING INSIDE SURFACE OF BOTTOM 5/8" FOAM - HEAT INSIDE SURFACE TO ROUND FOAM TO MATCH BKHD'S. HEAT & HOLD IN CURVED SHAPE UNTIL COOL - IT WILL HOLD THAT SHAPE.

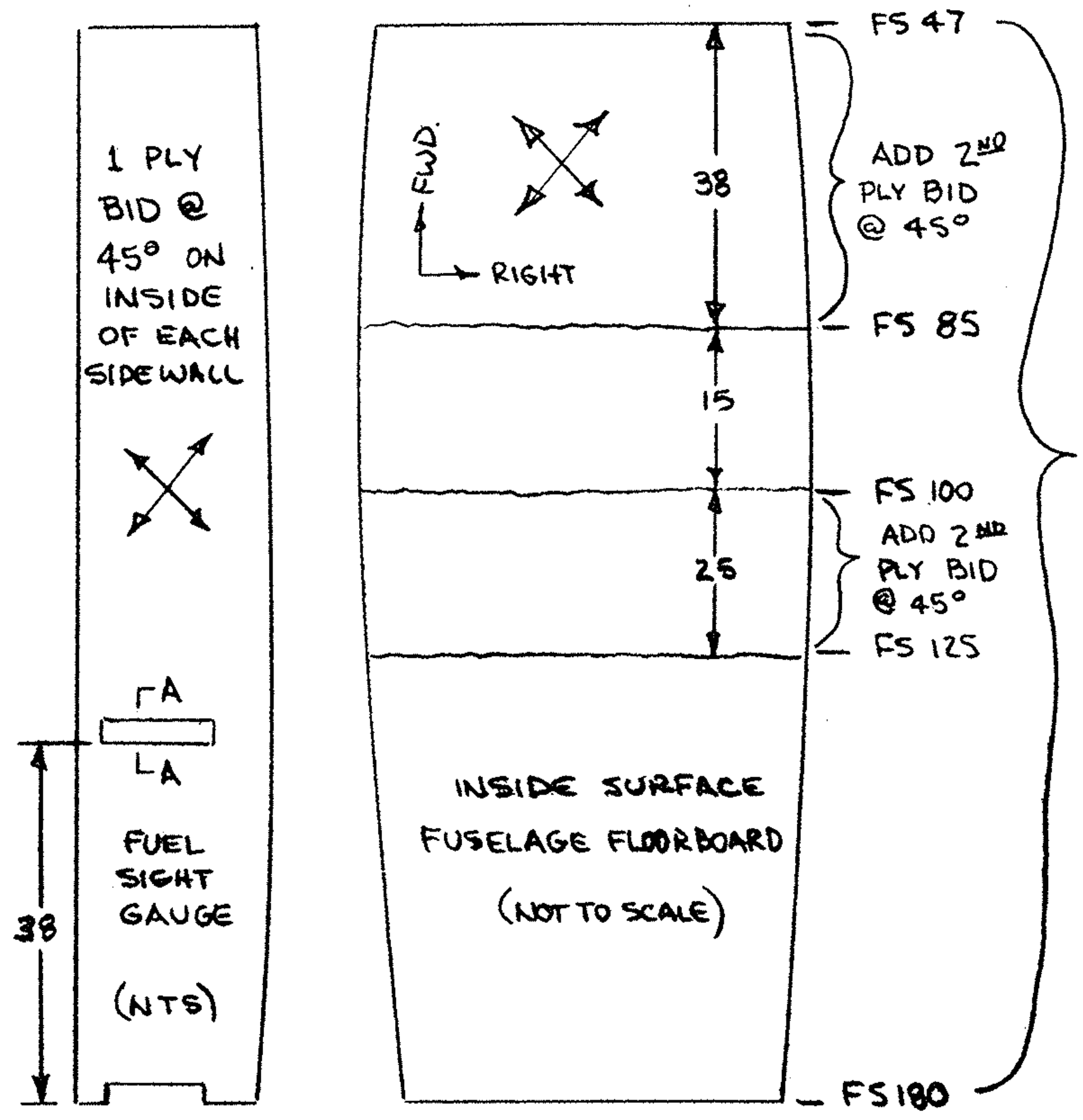

CORNER
8
8
LAYUP ① 2 PLIES UND ± 45°
8
CORNER
8
LAYUP ③ 1 16" WIDE PLY OF UND @ 0°- ORIENT. IS LENGTHWISE
3A
2A
LAYUP ② 2 PLIES UND ± 45°

DO FUEL SIGHT GAUGE BEFORE THESE LAYUPS

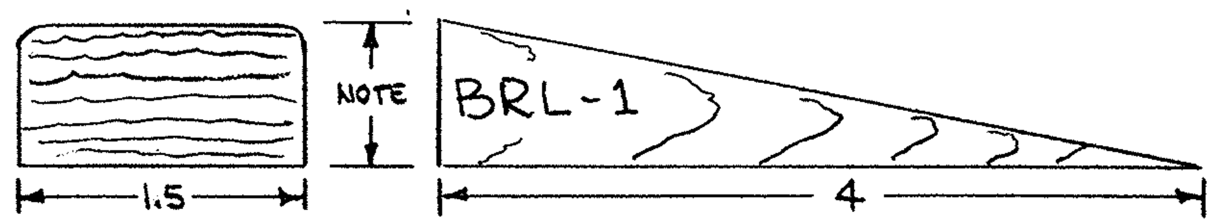
LAYUP SCEDULE

1) DO LAYUP ① IN ONE WORK PERIOD
2) DO LAYUPS ② & ③ IN ONE SEPARATE WORK PERIOD
3) DO LAYUPS ②A & ③A IN ONE SEPARATE WORK PERIOD

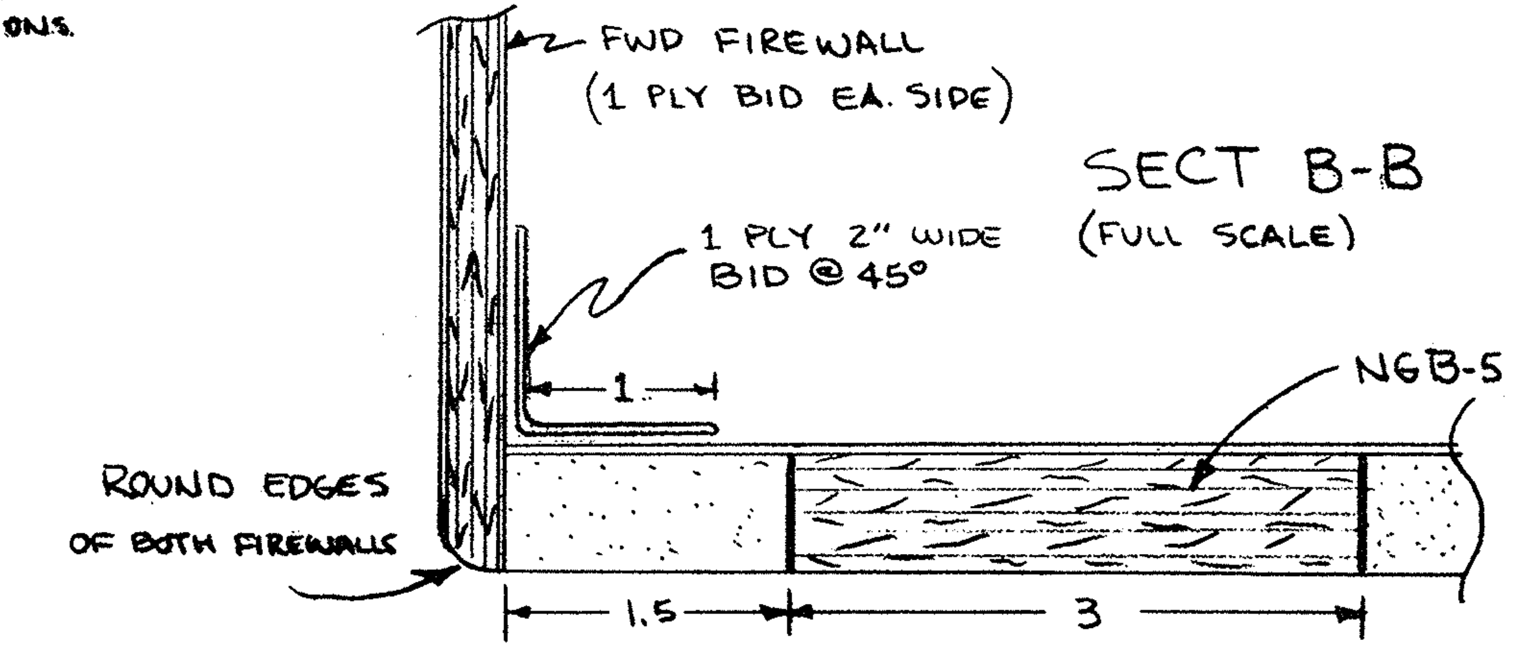
"DOING ANY TWO LAYUPS AT ONE TIME IS VERY TIRING."


1 PLY BID @ 45° ON INSIDE OF EACH SIDEWALL
A
A
FUEL SIGHT GAUGE
(NTS)
38
FS 47
FWD.
RIGHT
38
ADD 2ND PLY BID @ 45°
FS 85
15
FS 100
25
ADD 2ND PLY BID @ 45°
FS 125
INSIDE SURFACE FUSELAGE FLOORBOARD (NOT TO SCALE)
FS180
1 PLY BID @45° FULL LENGTH PLUS ADD 2ND PLY AT 2 LOCATIONS SHOWN

NOTE: ADJ. THICKNESS TO ESTABLISH THE .75" BTWN. BRL-1 AND ENGINE MOUNT HOLE. MAKE EIGHT FROM SPRUCE

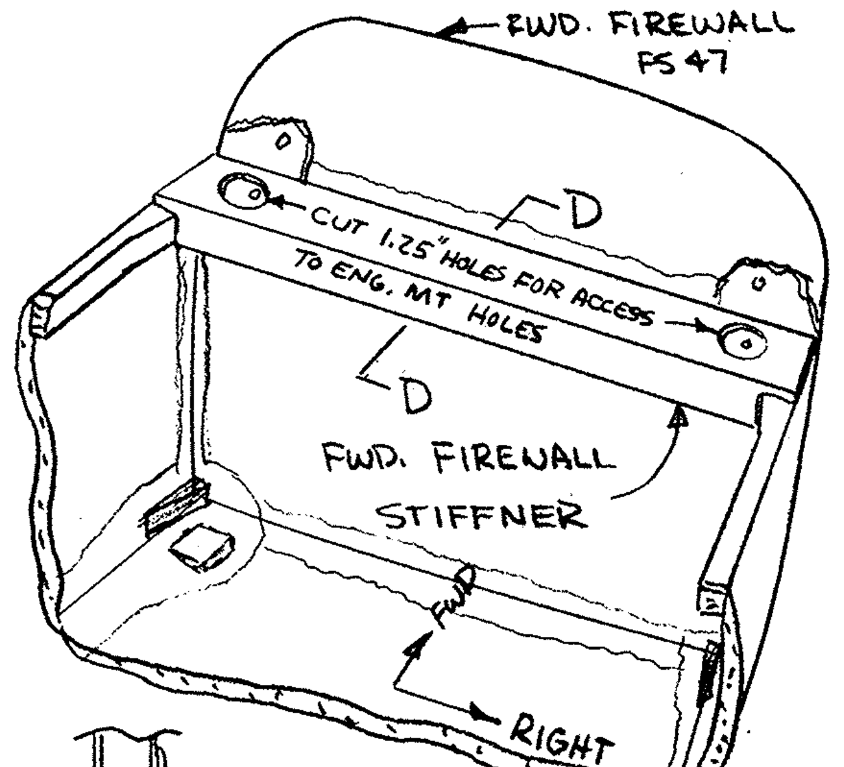


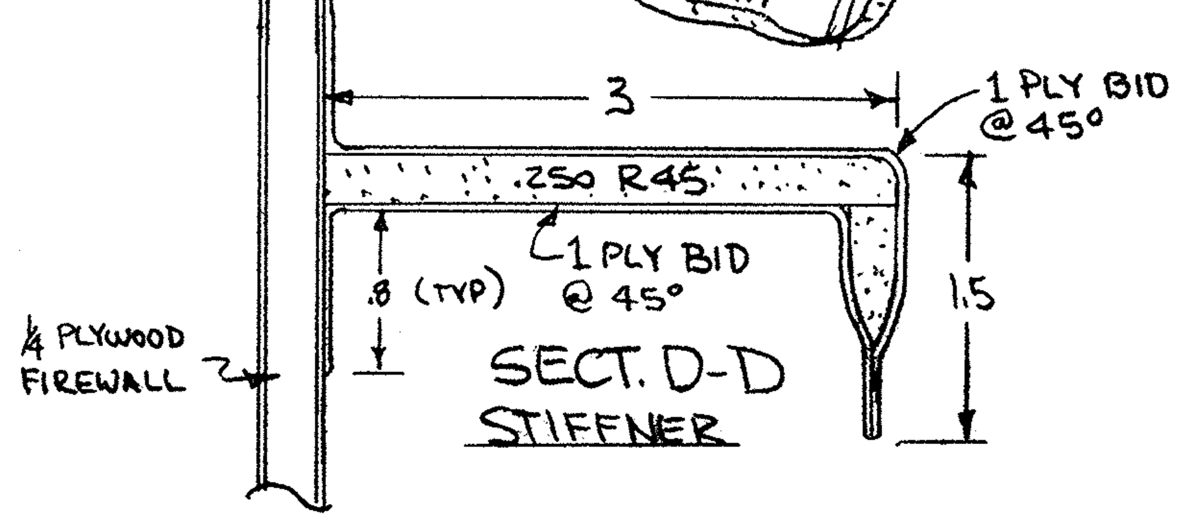
ADJUST SHAPE TO ALLOW TAILORED FIT IN CORNERS (FLOX INTO PLACE)


FWD FIREWALL (1 PLY BID EA. SIDE)
1 PLY 2" WIDE BID @ 45°
1
NGB-5
ROUND EDGES OF BOTH FIREWALLS
1.5
3

SECT B-B

(FULL SCALE)

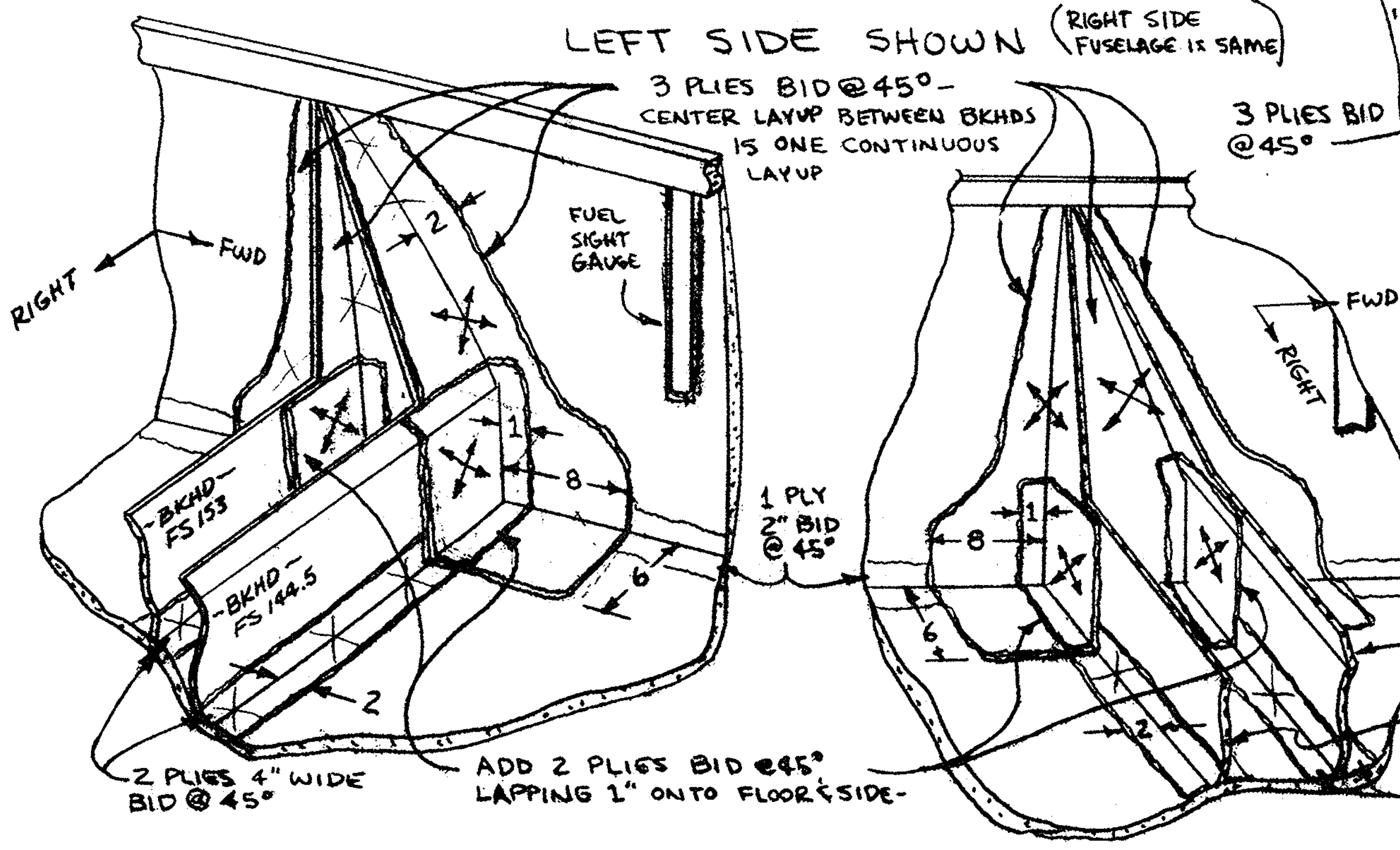


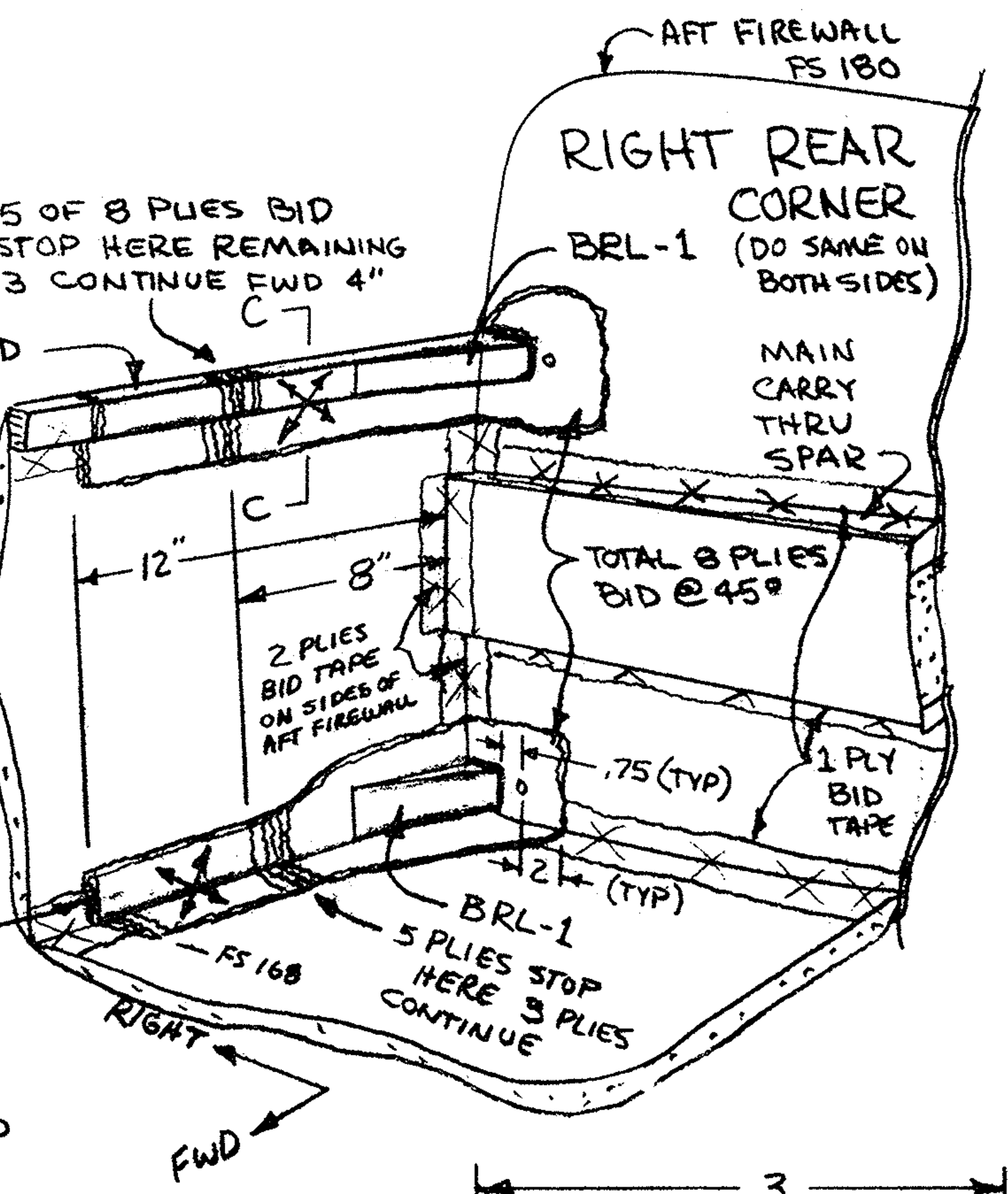


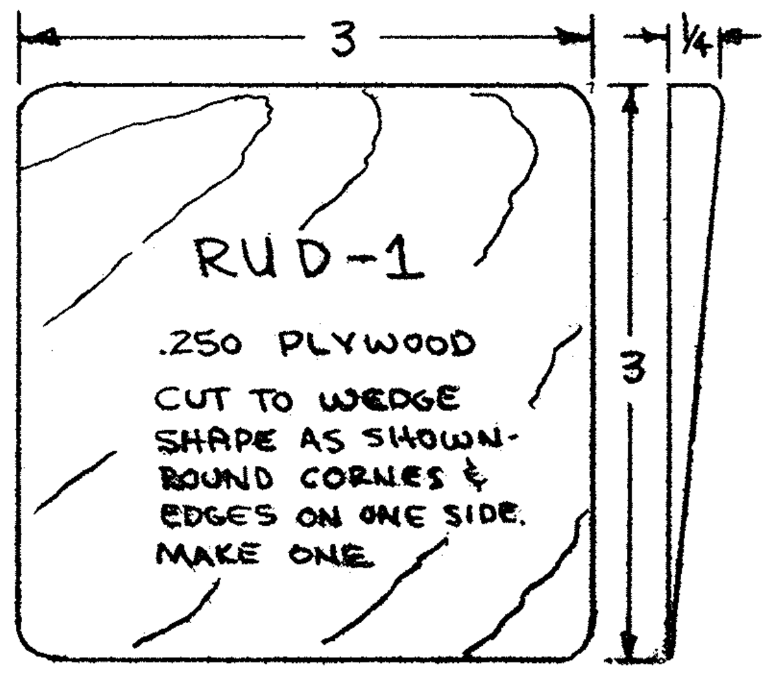
SECT. D-D

STIFFNER

LEFT SIDE SHOWN (RIGHT SIDE FUSELAGE IS SAME)

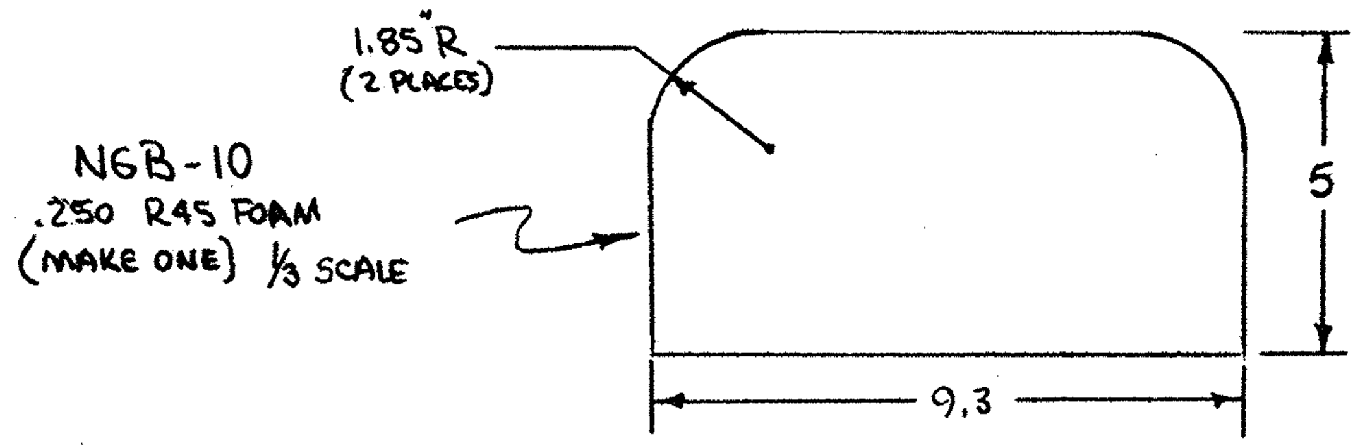

3 PLIES BID @45° - CENTER LAYUP BETWEEN BKHDS IS ONE CONTINUOUS LAYUP
RIGHT
FWD
2
FUEL SIGHT GAUGE
1
8
BKHD FS 153
BKHD FS 144.5
6
2
1 PLY 2" BID @ 45°
2 PLIES 4" WIDE BID @ 45°
ADD 2 PLIES BID @45° LAPPING 1" ONTO FLOOR & SIDE-
FWD
RIGHT
1
8
6
2
BKHD FS 144.5
BKHD FS 153
2 PLIES 4" WIDE BID @ 45° (TYPICAL) ON MAIN GEAR BOX

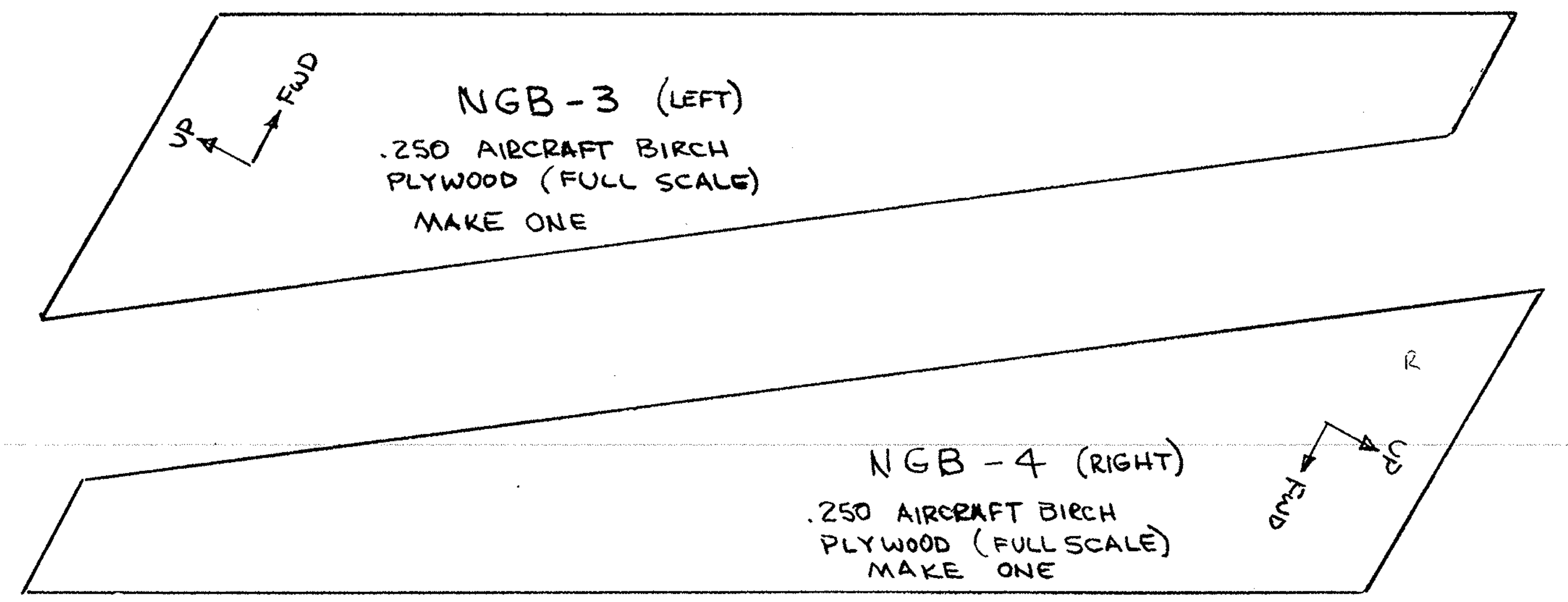


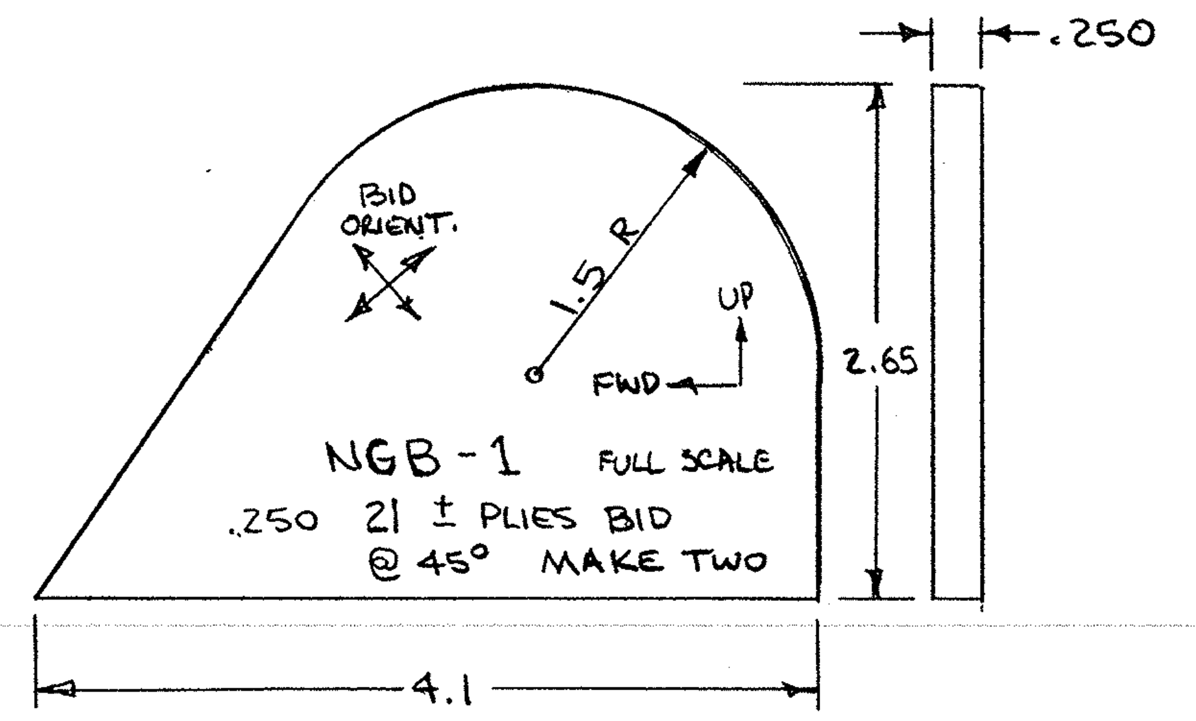


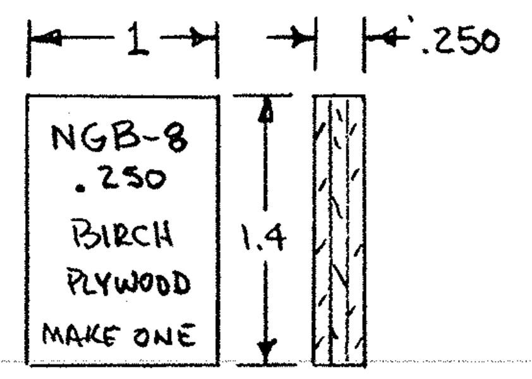
.250 PLYWOOD

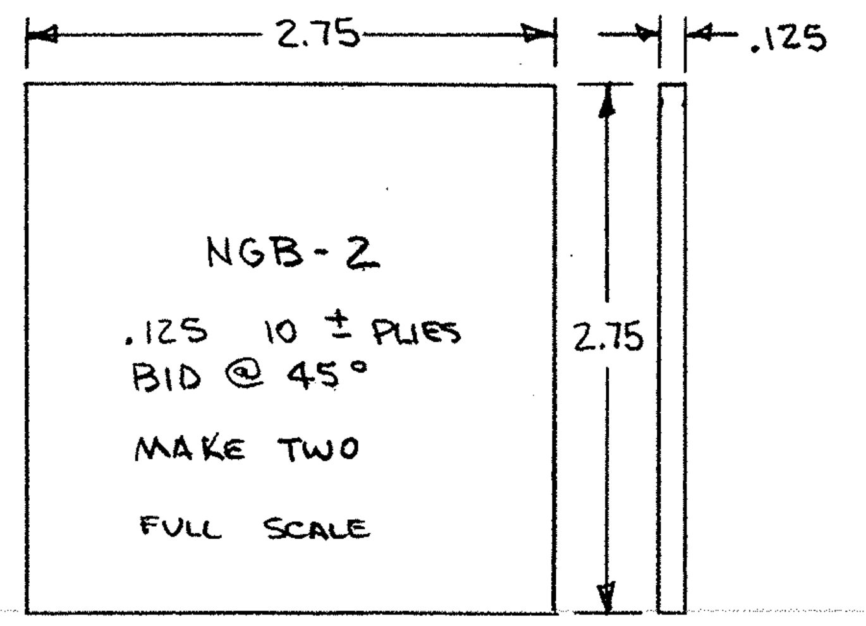
CUT TO WEDGE SHAPE AS SHOWN - ROUND CORNES & EDGES ON ONE SIDE. MAKE ONE

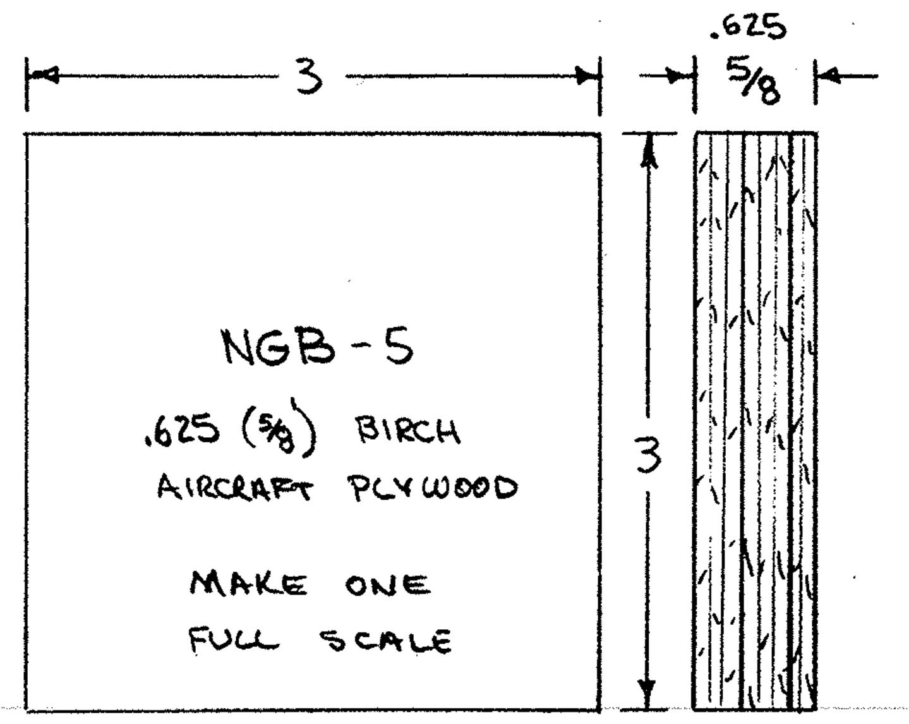




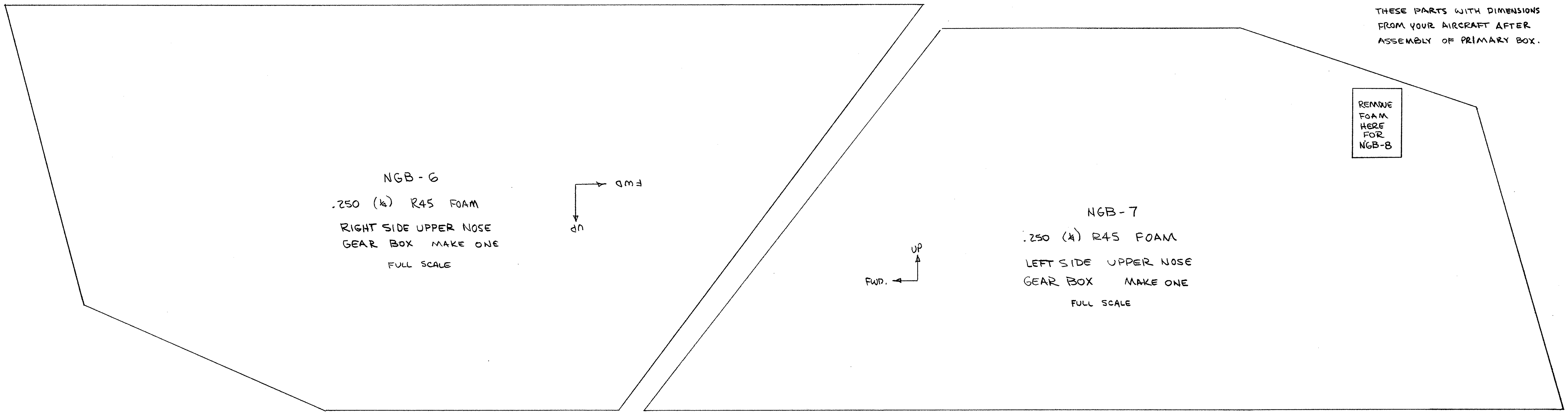


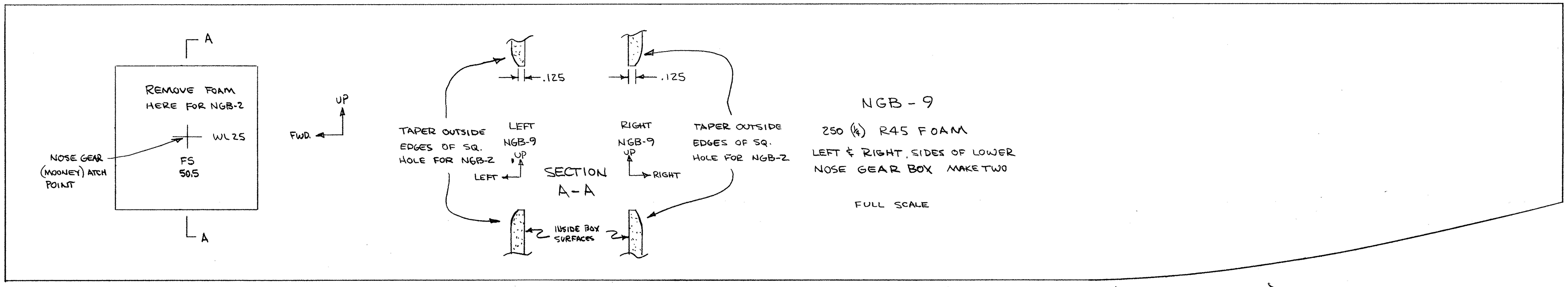




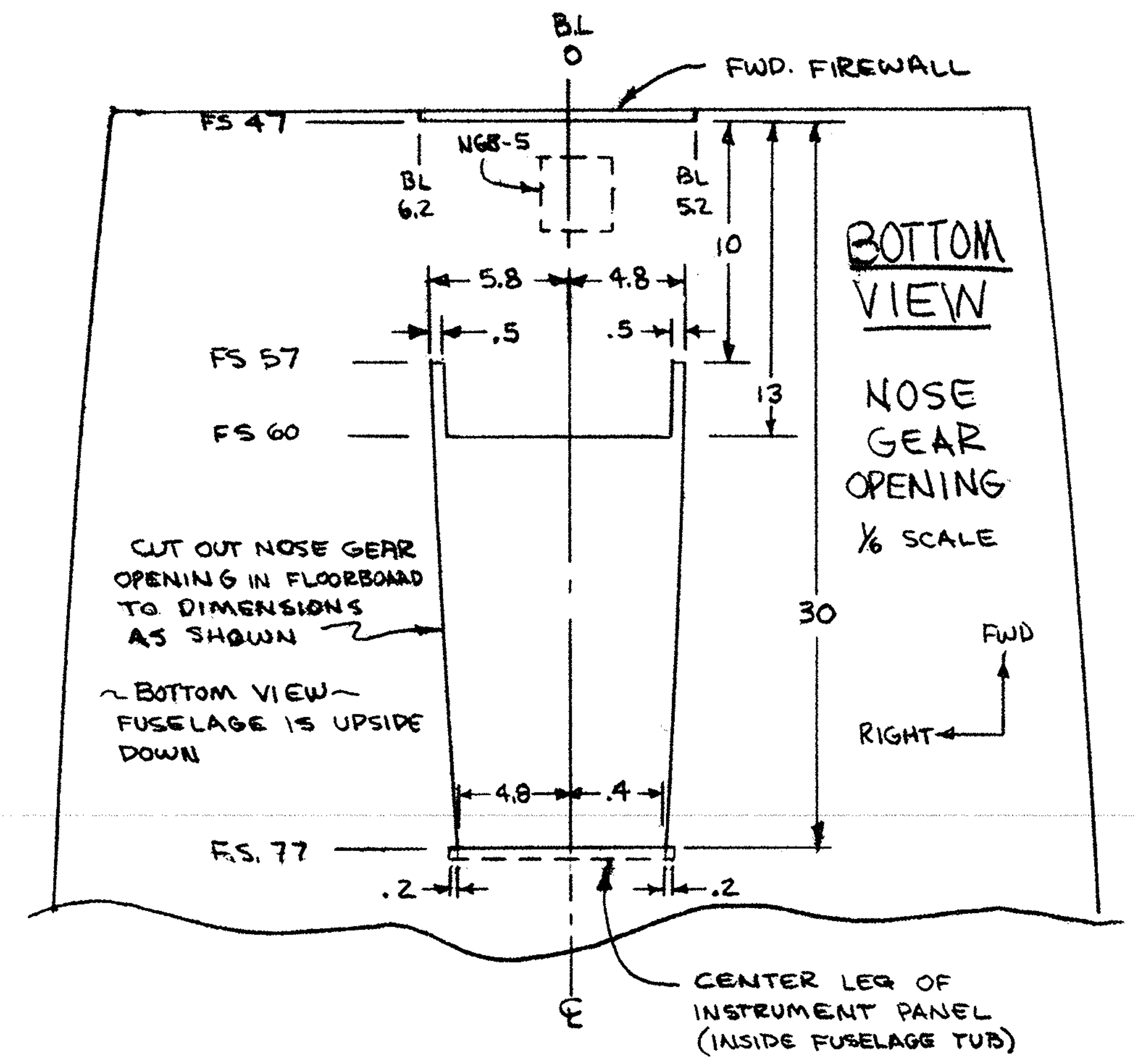


NOTE: NO PATTERNS ARE SHOWN FOR LID & FRONT COVER OF NOSE GEAR BOX. MAKE THESE PARTS WITH DIMENSIONS FROM YOUR AIRCRAFT AFTER ASSEMBLY OF PRIMARY BOX.





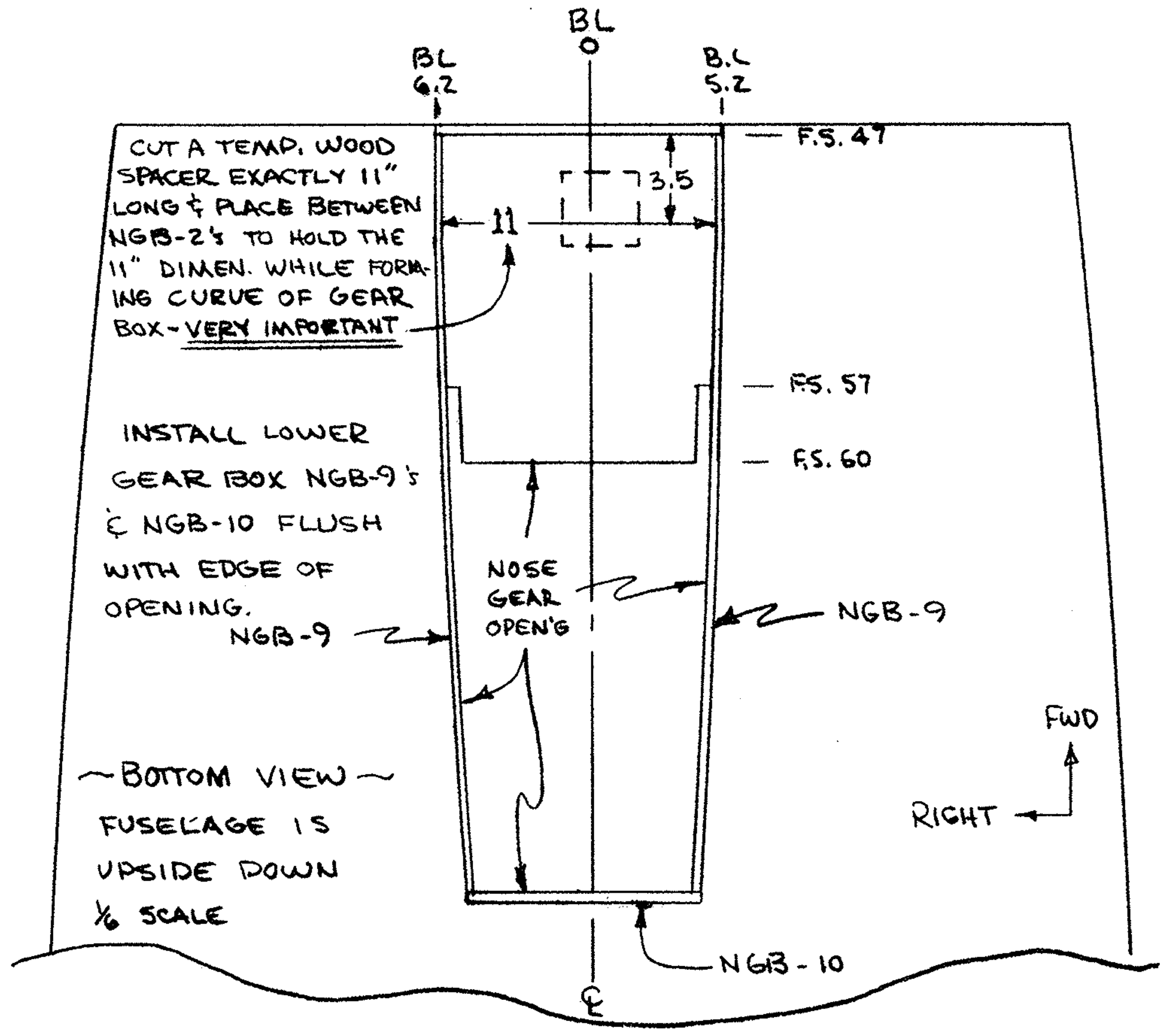
(SEE PAGE C-8)



CUT OUT NOSE GEAR OPENING IN FLOORBOARD TO DIMENSIONS AS SHOWN

~BOTTOM VIEW~ FUSELAGE IS UPSIDE DOWN

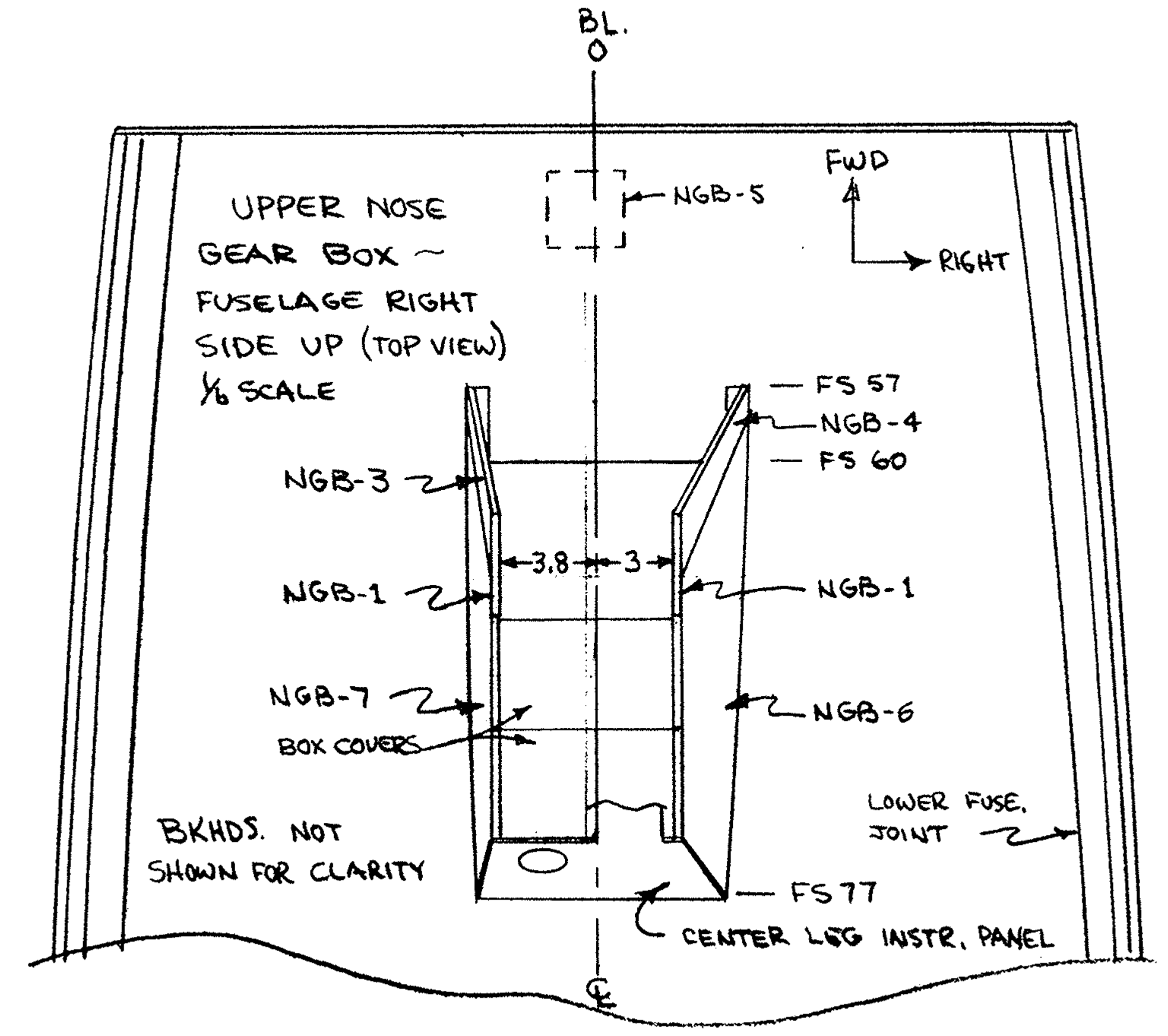
CENTER LEG OF INSTRUMENT PANEL (INSIDE FUSELAGE TUB)



CUT A TEMP. WOOD SPACER EXACTLY 11" LONG & PLACE BETWEEN NGB-2'S TO HOLD THE 11" DIMEN. WHILE FORM-ING CURVE OF GEAR BOX-VERY IMPORTANT

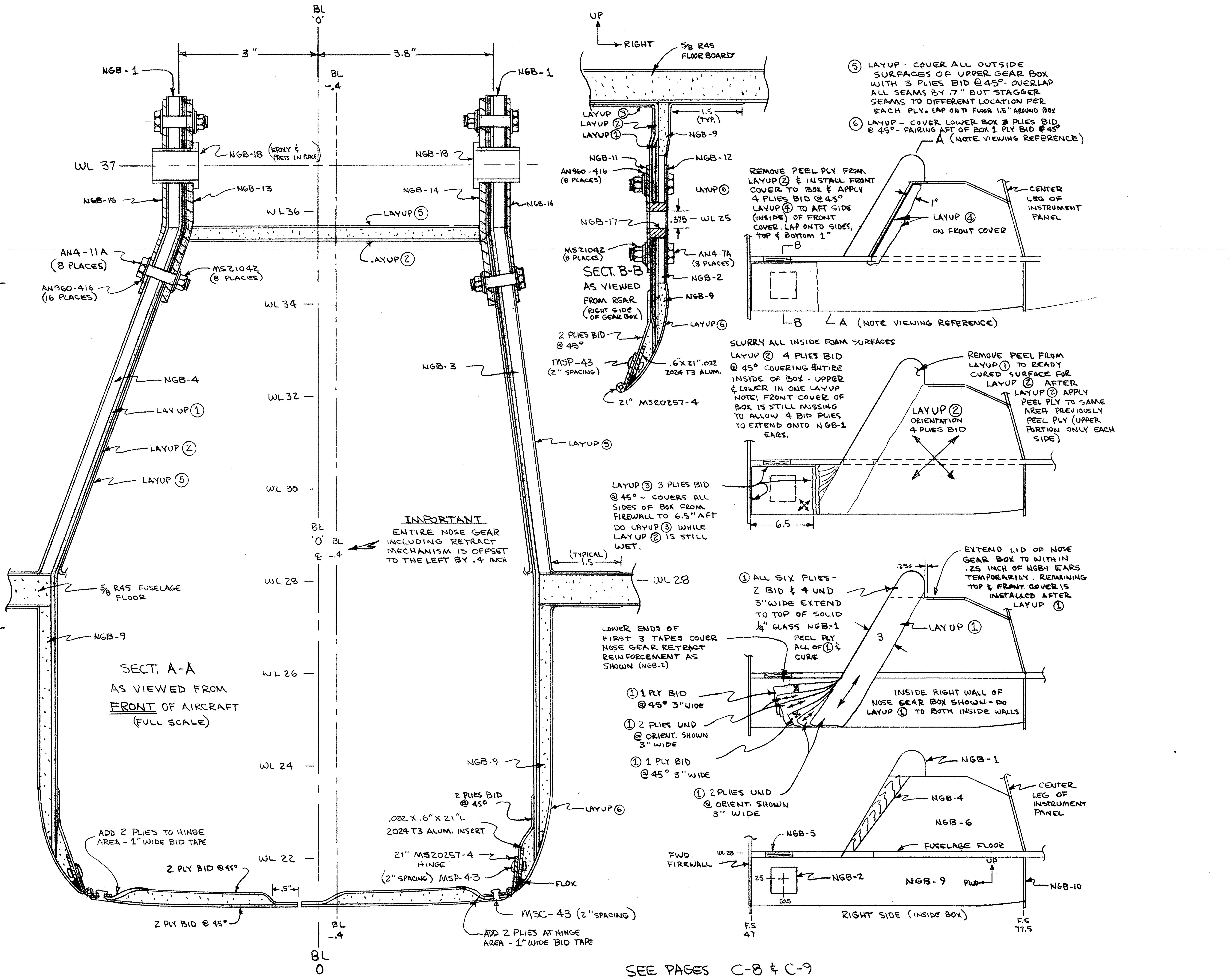
INSTALL LOWER GEAR BOX NGB-9'S & NGB-10 FLUSH WITH EDGE OF OPENING.

~BOTTOM VIEW~ FUSELAGE IS UPSIDE DOWN 1/6 SCALE



UPPER NOSE GEAR BOX ~ FUSELAGE RIGHT SIDE UP (TOP VIEW) 1/6 SCALE

BKHDS. NOT SHOWN FOR CLARITY



SECT. A-A AS VIEWED FROM FRONT OF AIRCRAFT (FULL SCALE)

IMPORTANT
ENTIRE NOSE GEAR INCLUDING RETRACT MECHANISM IS OFFSET TO THE LEFT BY .4 INCH

ADD 2 PLIES TO HINGE AREA - 1" WIDE BID TAPE

ADD 2 PLIES AT HINGE AREA - 1" WIDE BID TAPE

SECT. B-B AS VIEWED FROM REAR (RIGHT SIDE OF GEAR BOX)

⑤ LAYUP - COVER ALL OUTSIDE SURFACES OF UPPER GEAR BOX WITH 3 PLIES BID @ 45°- OVERLAP ALL SEAMS BY .7" BUT STAGGER SEAMS TO DIFFERENT LOCATION PER EACH PLY. LAP ONTO FLOOR 1.5" AROUND BOX

⑥ LAYUP - COVER LOWER BOX 3 PLIES BID @ 45°- FAIRING AFT OF BOX 1 PLY BID @ 45°

REMOVE PEEL PLY FROM LAYUP ② & INSTALL FRONT COVER TO BOX & APPLY 4 PLIES BID @ 45° LAYUP ④ TO AFT SIDE (INSIDE) OF FRONT COVER. LAP ONTO SIDES, TOP & BOTTOM 1"

SLURRY ALL INSIDE FOAM SURFACES

LAYUP ② 4 PLIES BID @ 45° COVERING ENTIRE INSIDE OF BOX - UPPER & LOWER IN ONE LAYUP
NOTE: FRONT COVER OF BOX IS STILL MISSING TO ALLOW 4 BID PLIES TO EXTEND ONTO NGB-1 EARS.

REMOVE PEEL FROM LAYUP ① TO READY CURED SURFACE FOR LAYUP ② AFTER LAYUP ② APPLY PEEL PLY TO SAME AREA PREVIOUSLY PEEL PLY (UPPER PORTION ONLY EACH SIDE)

LAYUP ③ 3 PLIES BID @ 45° - COVERS ALL SIDES OF BOX FROM FIREWALL TO 6.5" AFT DO LAYUP ③ WHILE LAY UP ② IS STILL WET.

EXTEND LID OF NOSE GEAR BOX TO WITHIN .25 INCH OF NGB-1 EARS TEMPORARILY. REMAINING TOP & FRONT COVER IS INSTALLED AFTER LAYUP ①

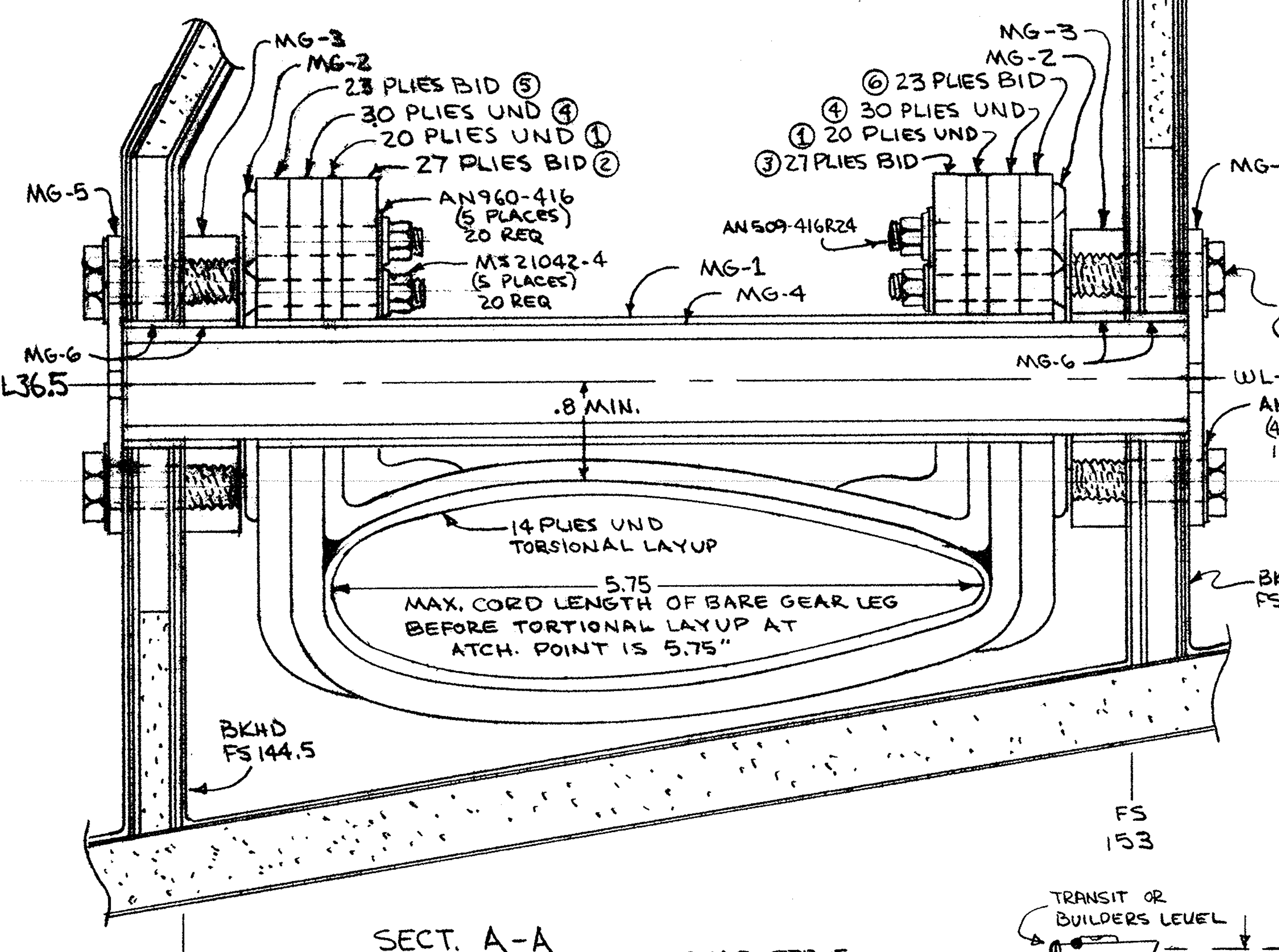
① ALL SIX PLIES - 2 BID & 4 UND 3" WIDE EXTEND TO TOP OF SOLID 1/4" GLASS NGB-1

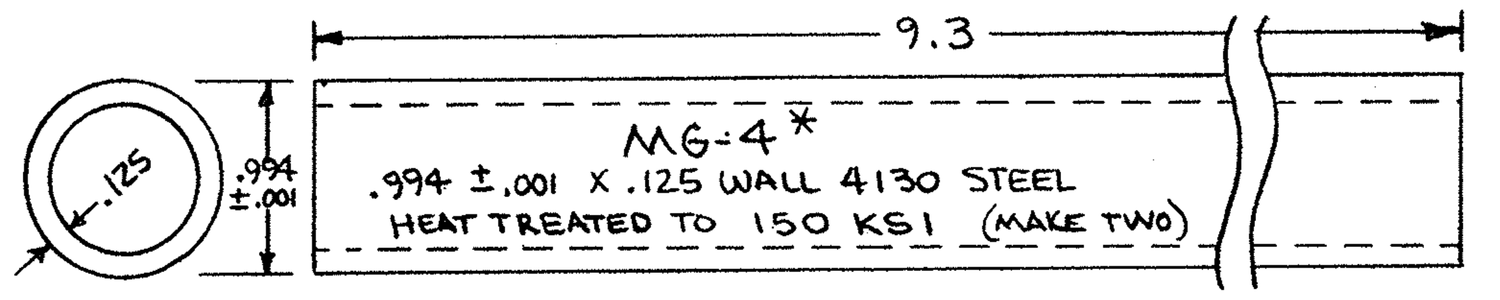
LOWER ENDS OF FIRST 3 TAPES COVER NOSE GEAR RETRACT REINFORCEMENT AS SHOWN (NGB-2)

INSIDE RIGHT WALL OF NOSE GEAR BOX SHOWN - DO LAYUP ① TO BOTH INSIDE WALLS

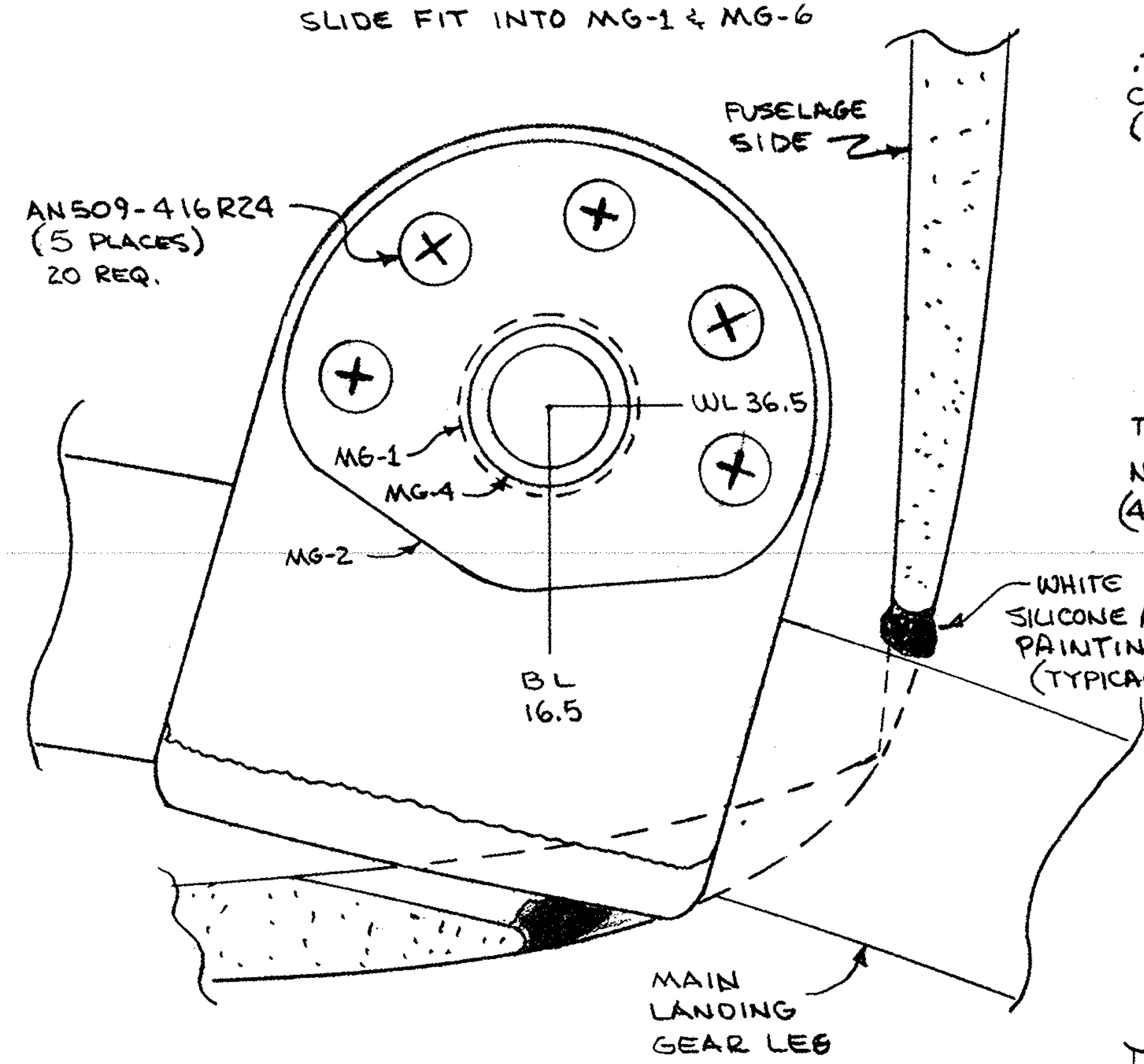
SEE PAGES C-8 & C-9

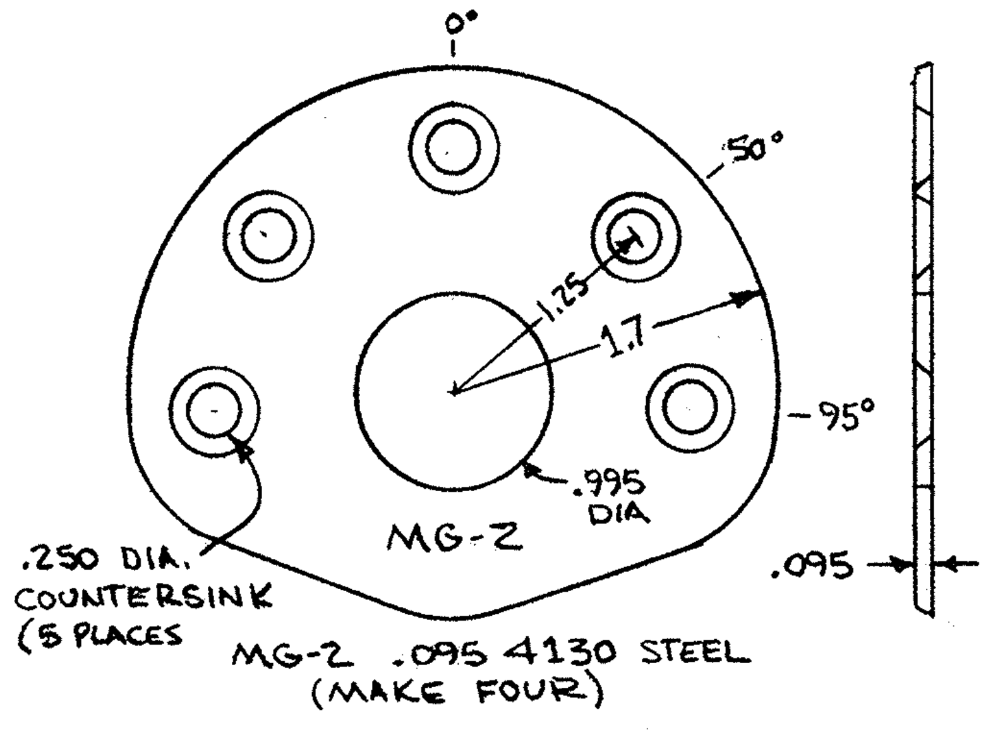
CROSS SECTION OF MAIN LANDING GEAR ATCH. (FULL SCALE)



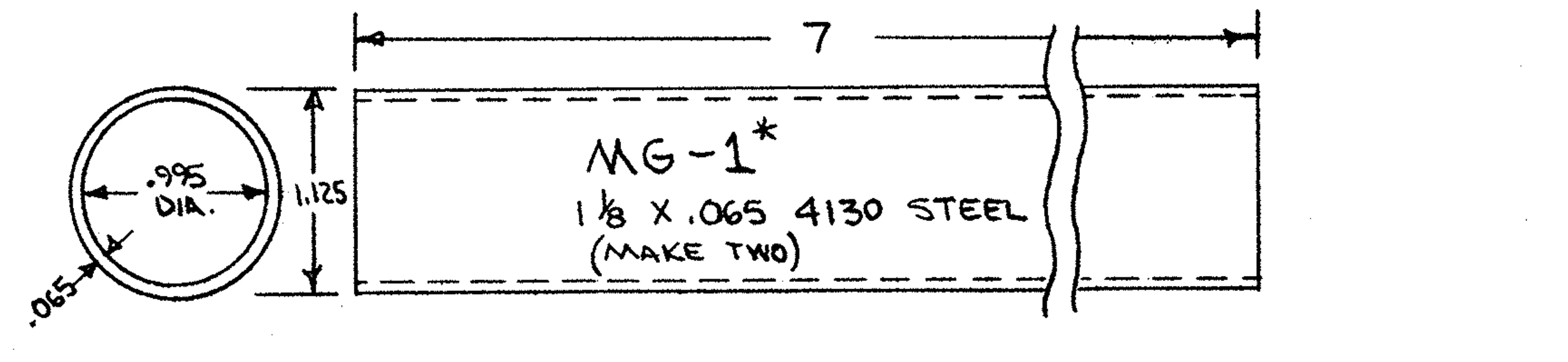

.125
.994 ±.001
9.3
MG-4 *
.994 ±.001 X .125 WALL 4130 STEEL
HEAT TREATED TO 150 KSI (MAKE TWO)

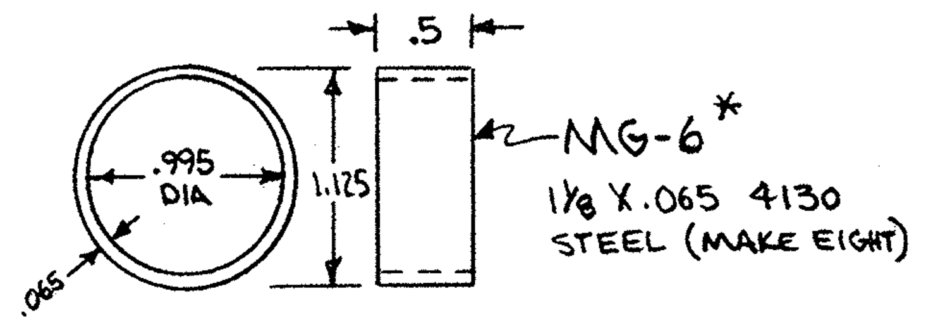
* MG-4 MUST BE MACHINED TO PROVIDE SLIDE FIT INTO MG-1 & MG-6

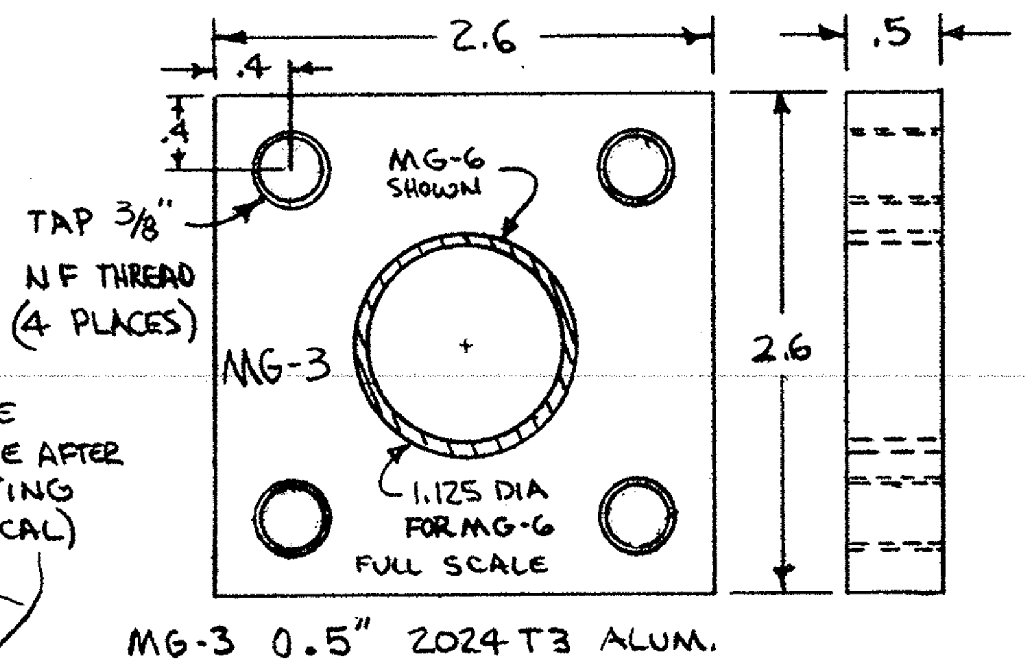




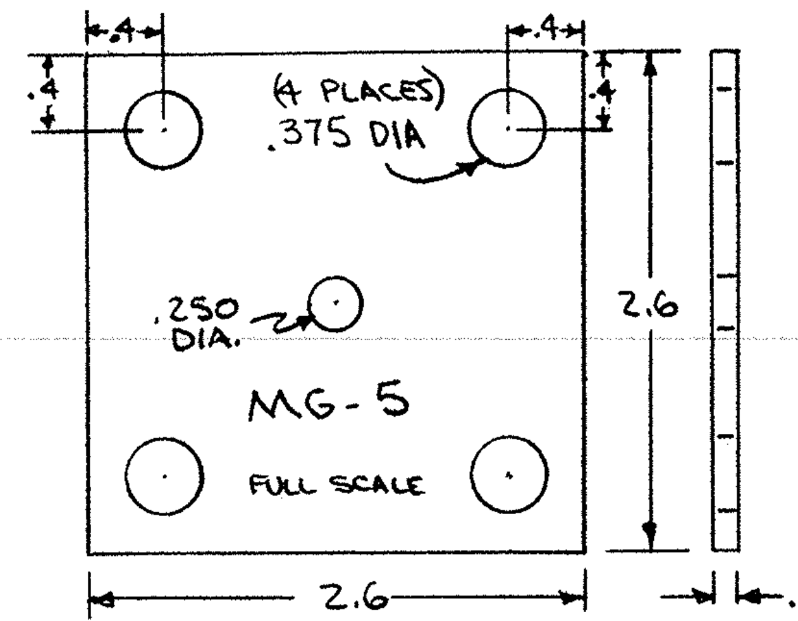
MG-2 .095 4130 STEEL (MAKE FOUR)



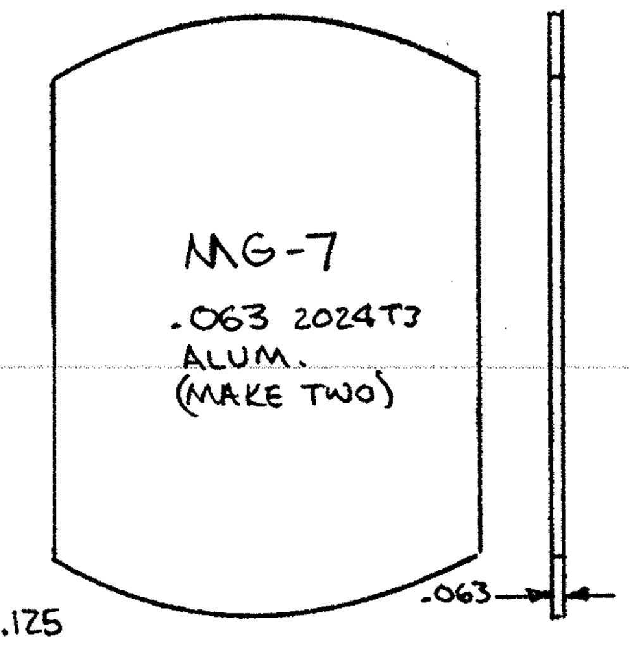


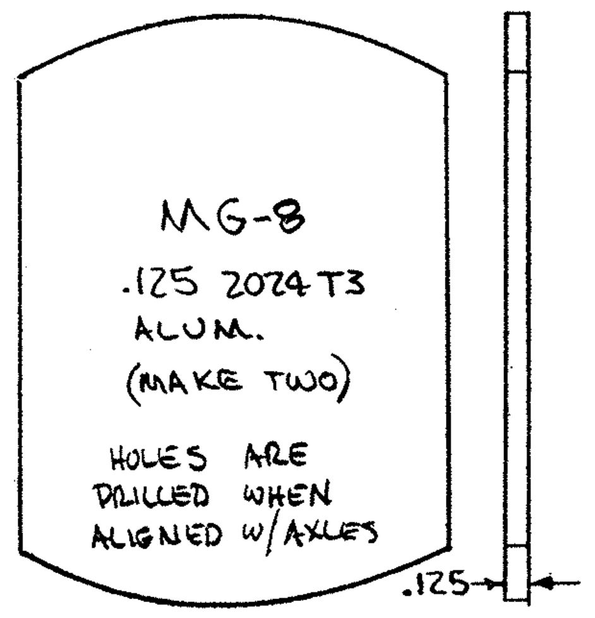


MG-3 0.5" 2024T3 ALUM.
(MAKE FOUR) STACK DRILL
NOTE- MG-6 BUSHING IS INSERTED

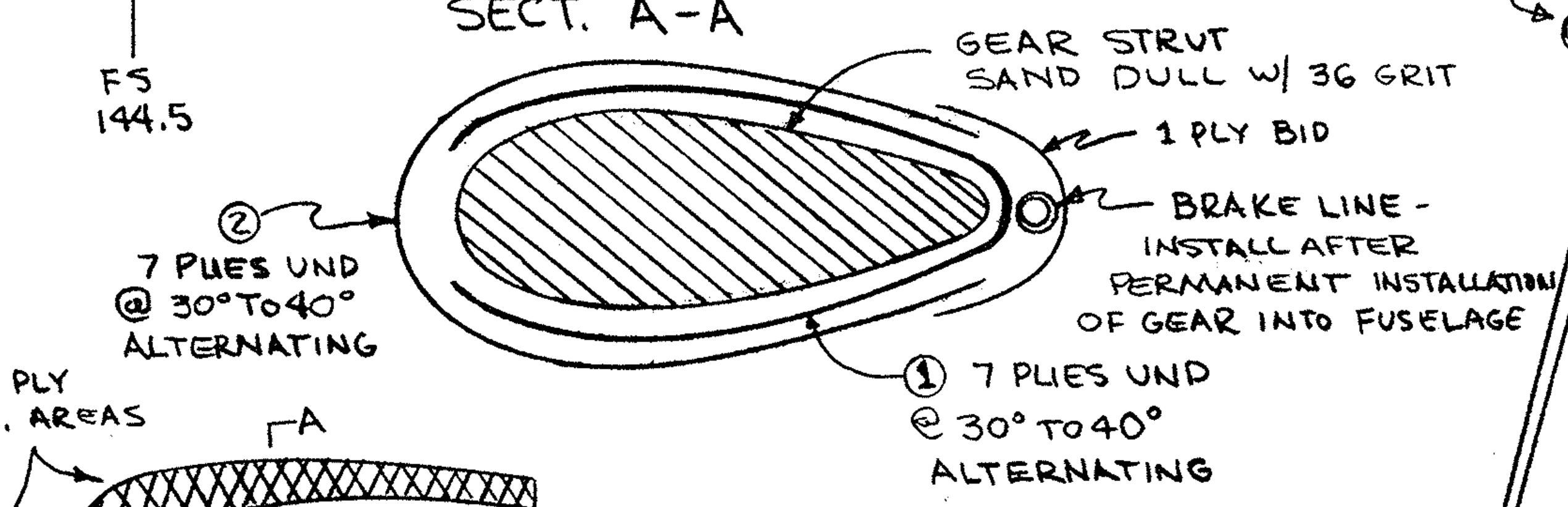


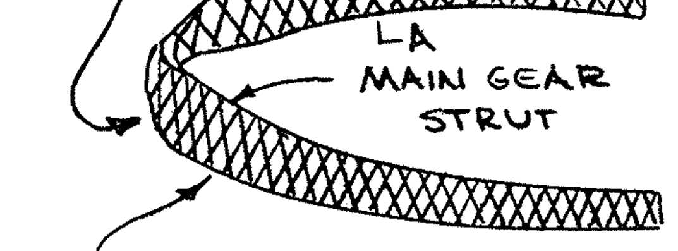
MG-5 .125" 2024T3 ALUM.
(MAKE FOUR) STACK DRILL



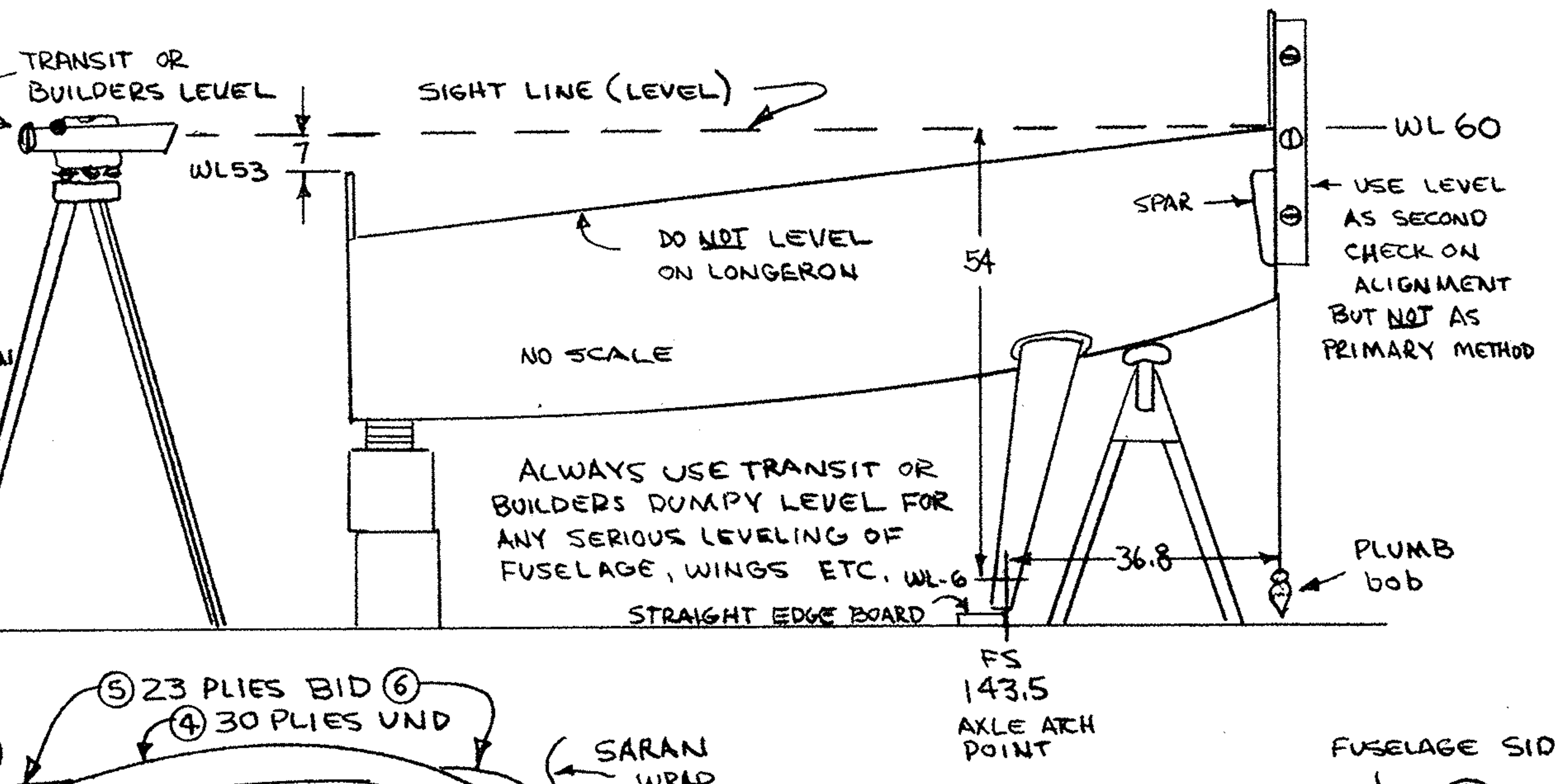


SECT. A-A

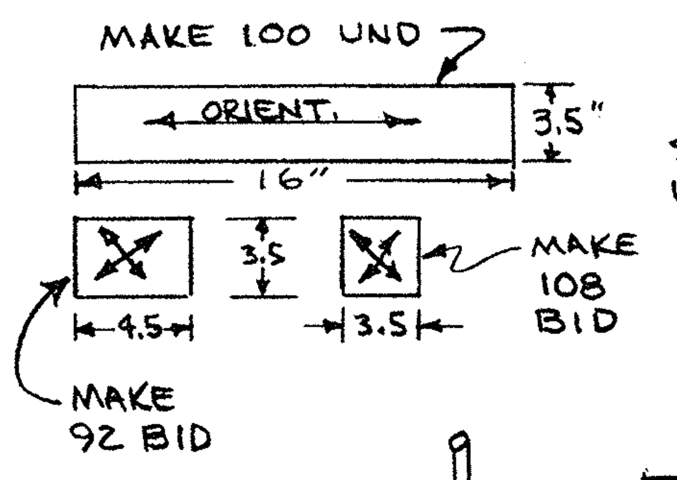


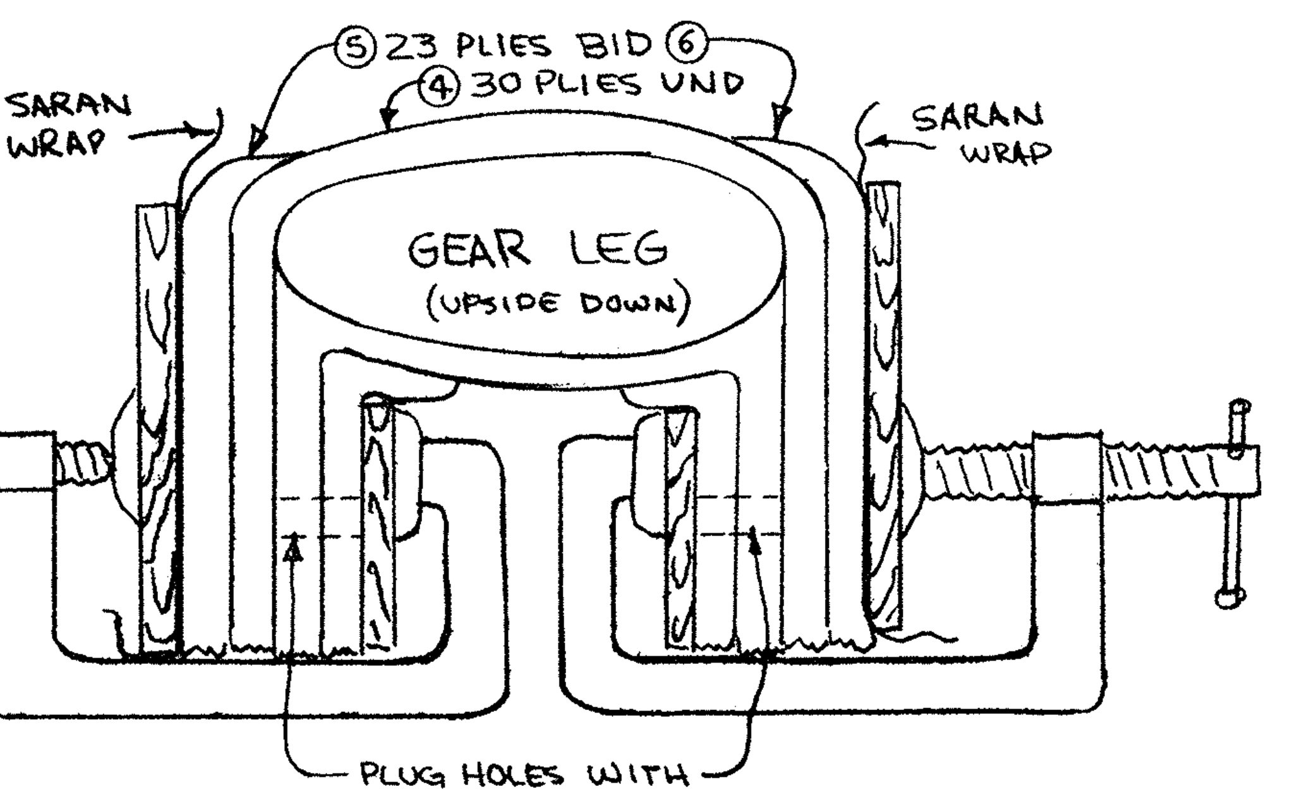


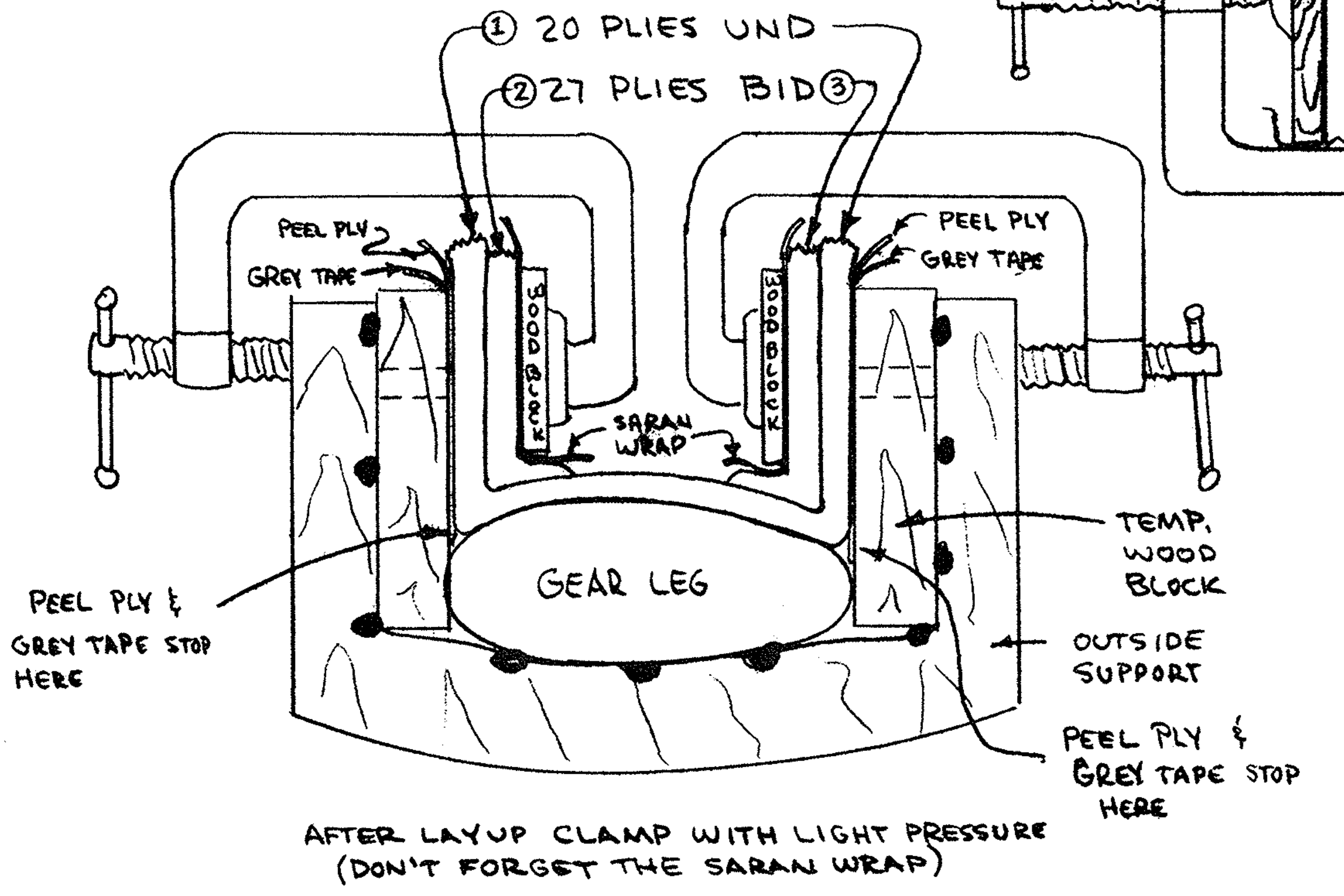
14 PLIES UND ALTERNATING 30° TO 40° THIS LAYUP **MUST** BE DONE BEFORE ATTACH TABS ARE LAID UP AND AXLES ARE MOUNTED



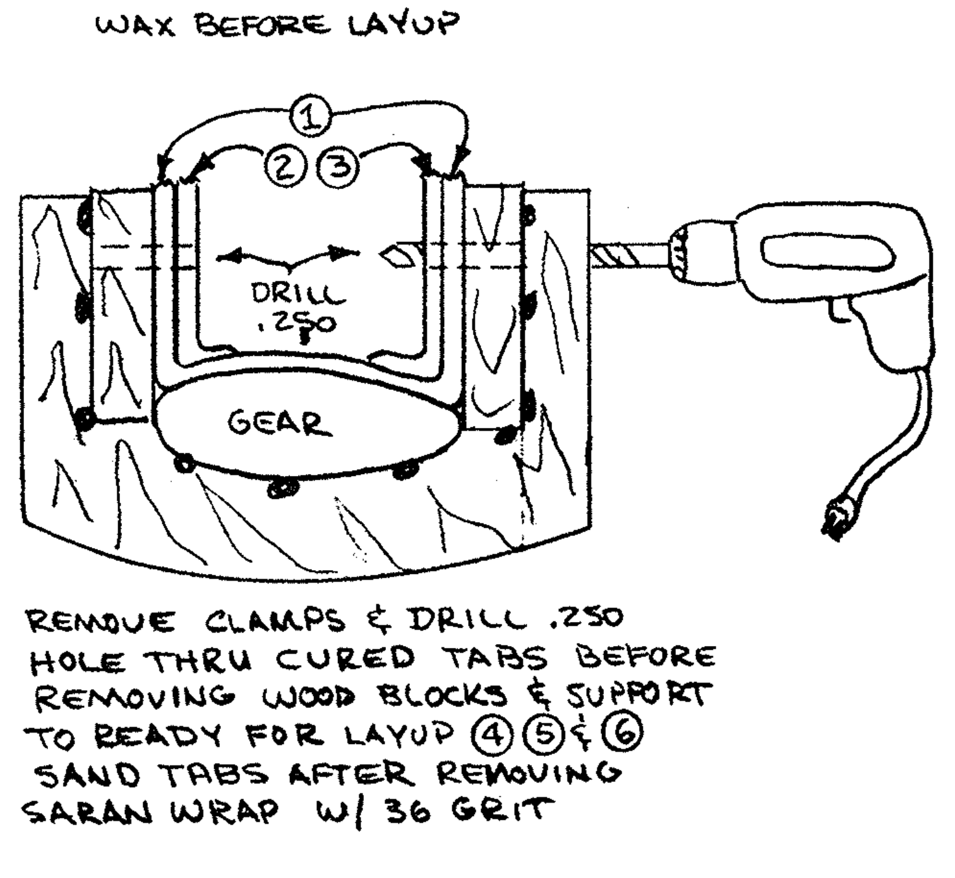
ALWAYS USE TRANSIT OR BUILDERS DUMPY LEVEL FOR ANY SERIOUS LEVELING OF FUSELAGE, WINGS ETC.



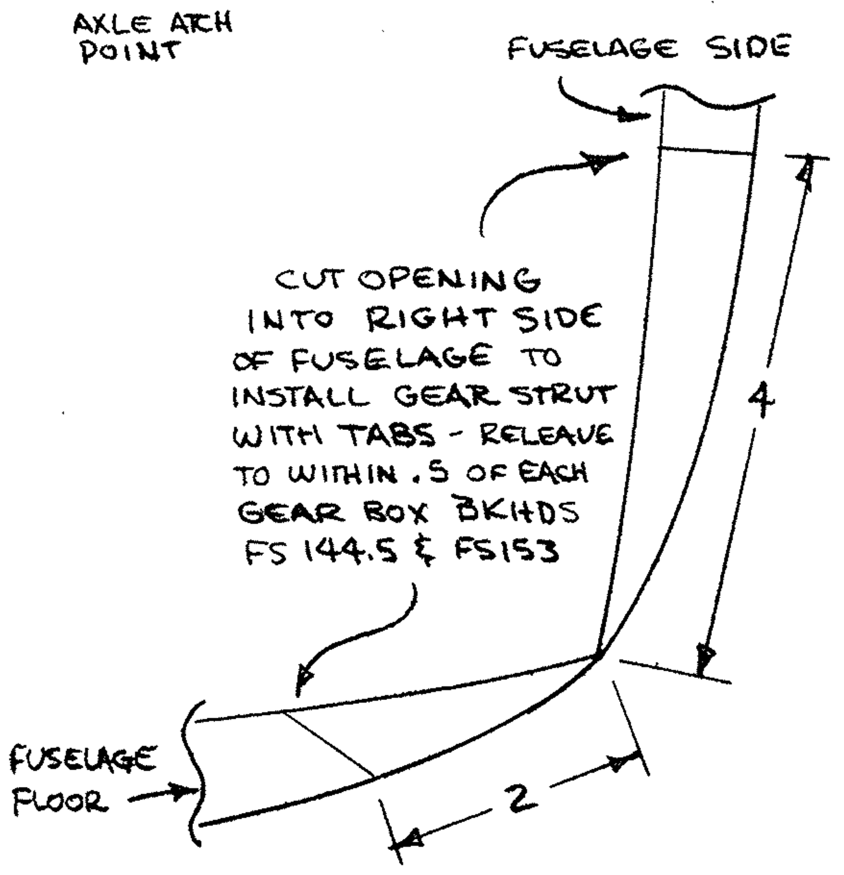




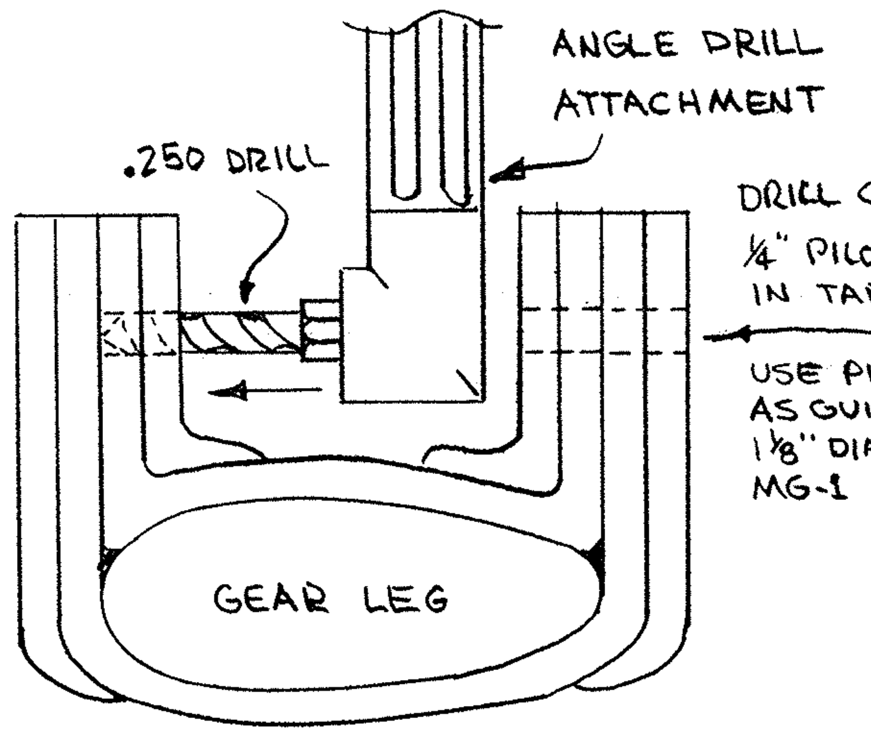
AFTER LAYUP CLAMP WITH LIGHT PRESSURE (DON'T FORGET THE SARAN WRAP)



REMOVE CLAMPS & DRILL .250 HOLE THRU CURED TABS BEFORE REMOVING WOOD BLOCKS & SUPPORT TO READY FOR LAYUP ④⑤&⑥ SAND TABS AFTER REMOVING SARAN WRAP W/ 36 GRIT

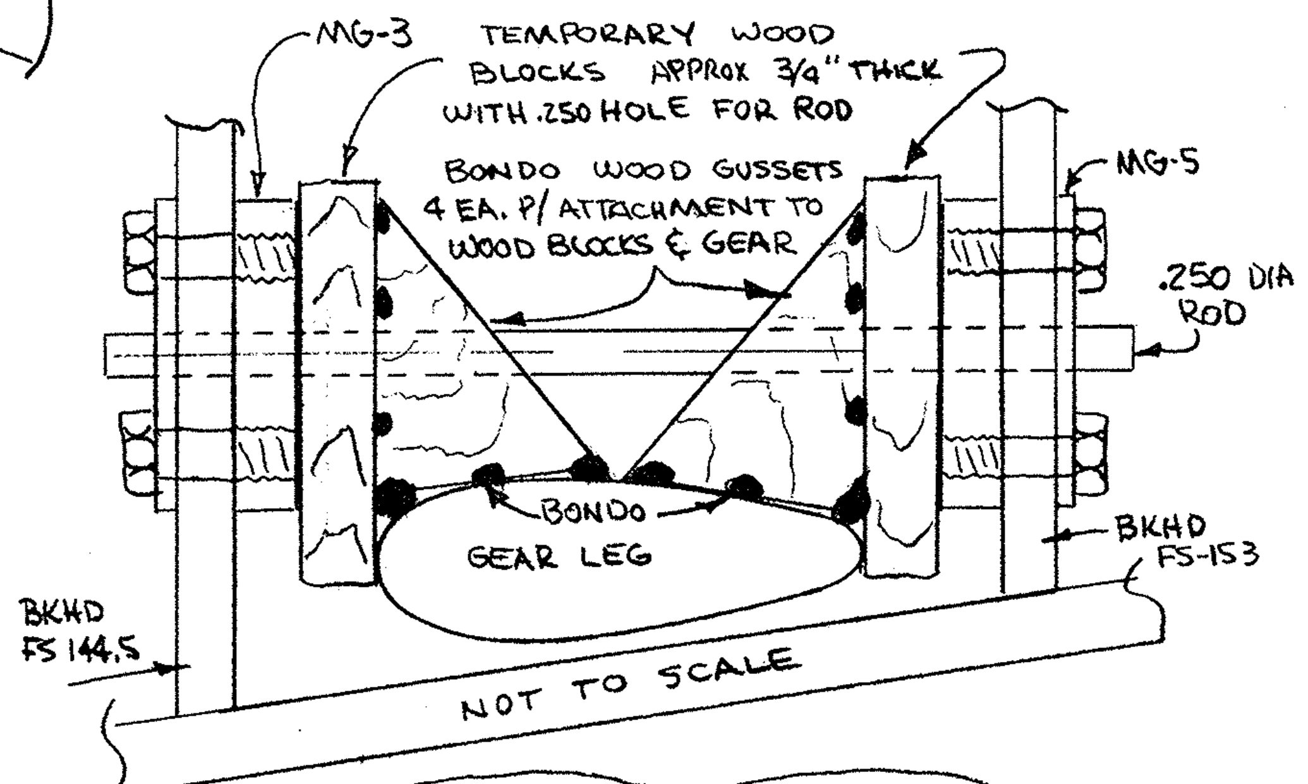


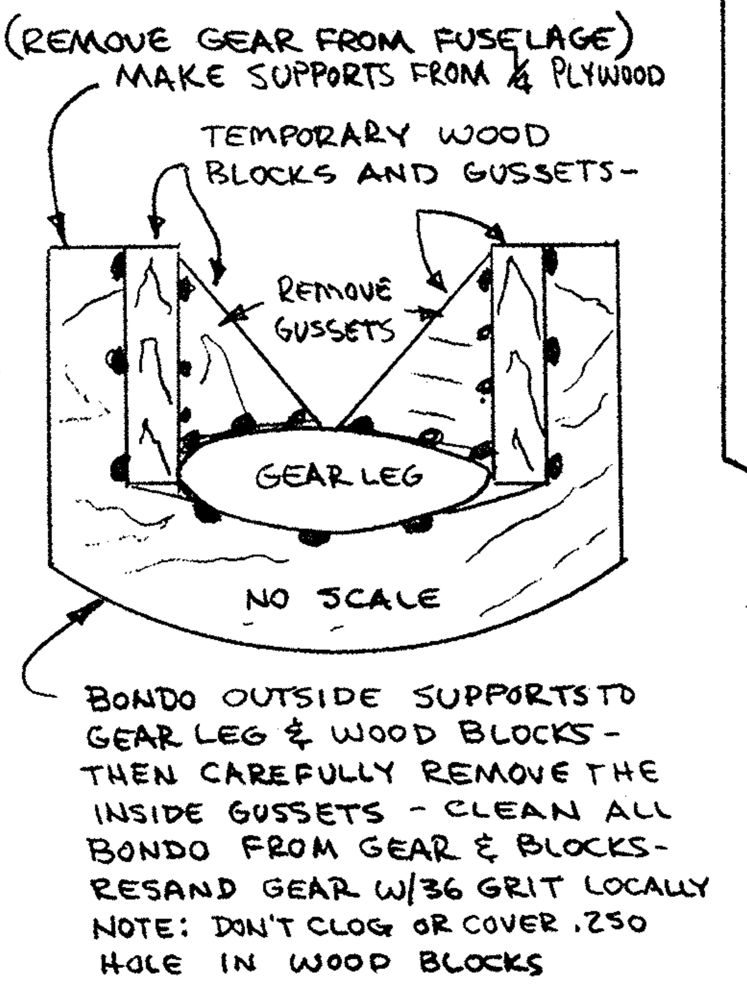
CUT OPENING INTO RIGHT SIDE OF FUSELAGE TO INSTALL GEAR STRUT WITH TABS - RELEASE TO WITHIN .5 OF EACH GEAR BOX BKHDS FS 144.5 & FS153



DRILL OUT ¼" PILOT HOLES IN TABS

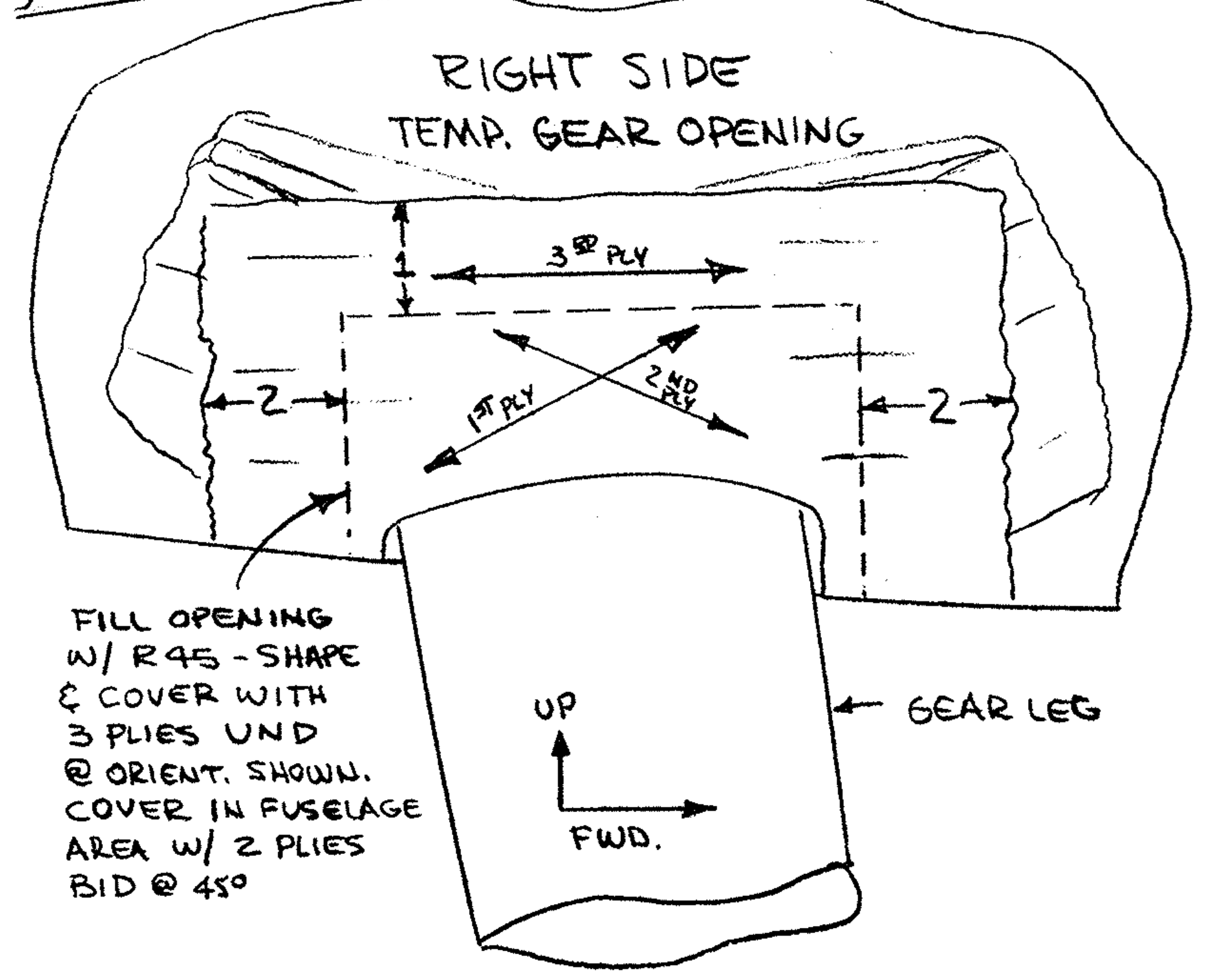
USE PILOT HOLES AS GUIDE TO CUT 1⅛" DIA. HOLE FOR MG-1


MG-3
TEMPORARY WOOD BLOCKS APPROX ¾" THICK WITH .250 HOLE FOR ROD
BONDO WOOD GUSSETS 4 EA. P/ ATTACHMENT TO WOOD BLOCKS & GEAR
MG-5
.250 DIA ROD
BONDO
GEAR LEG
BKHD
FS-153
BKHD
FS 144.5
NOT TO SCALE

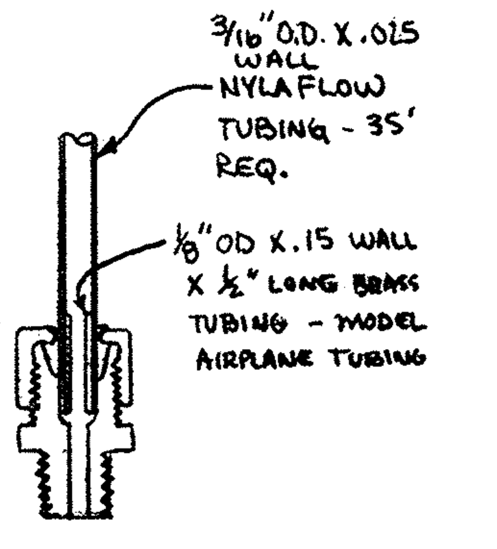

(REMOVE GEAR FROM FUSELAGE)
MAKE SUPPORTS FROM ⅛ PLYWOOD
TEMPORARY WOOD BLOCKS AND GUSSETS-
REMOVE GUSSETS
GEAR LEG
NO SCALE

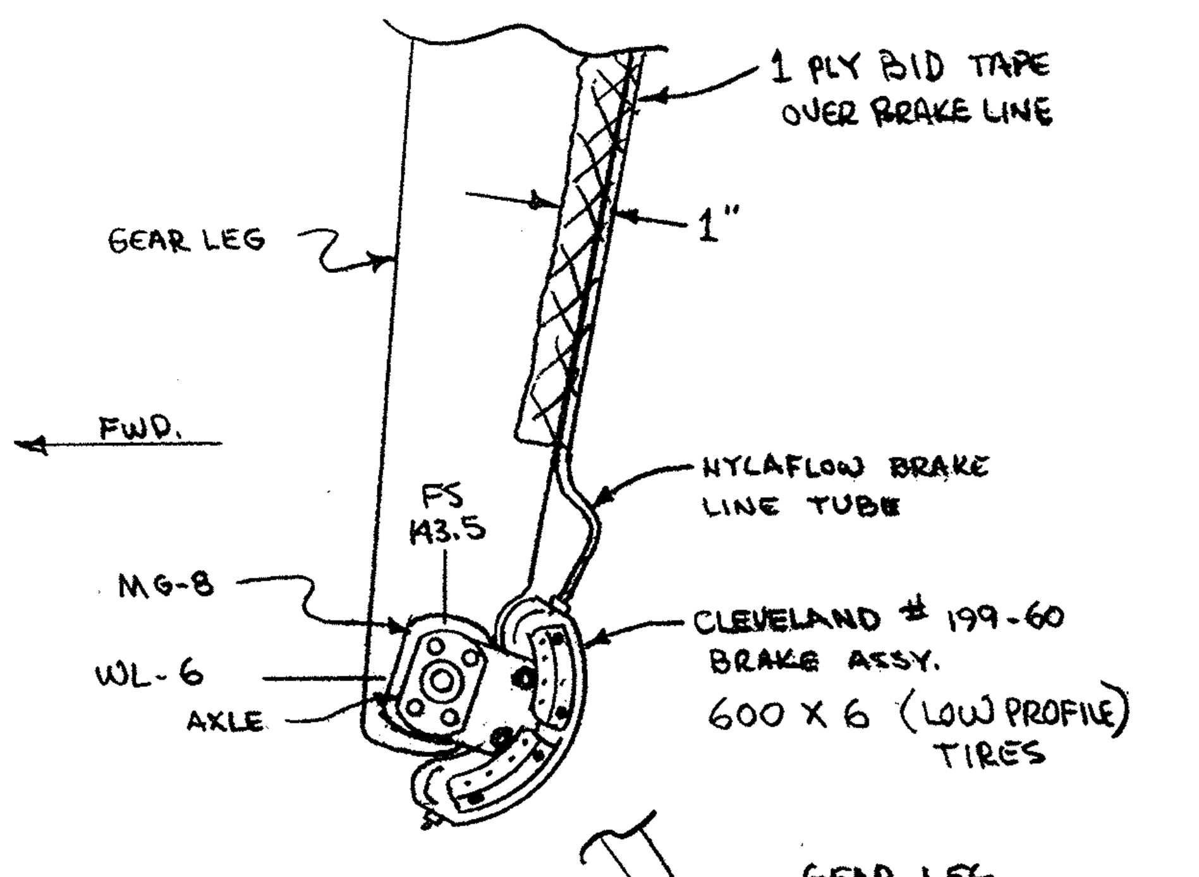
BONDO OUTSIDE SUPPORTS TO GEAR LEG & WOOD BLOCKS - THEN CAREFULLY REMOVE THE INSIDE GUSSETS - CLEAN ALL BONDO FROM GEAR & BLOCKS - RESAND GEAR W/36 GRIT LOCALLY NOTE: DON'T CLOG OR COVER .250 HOLE IN WOOD BLOCKS

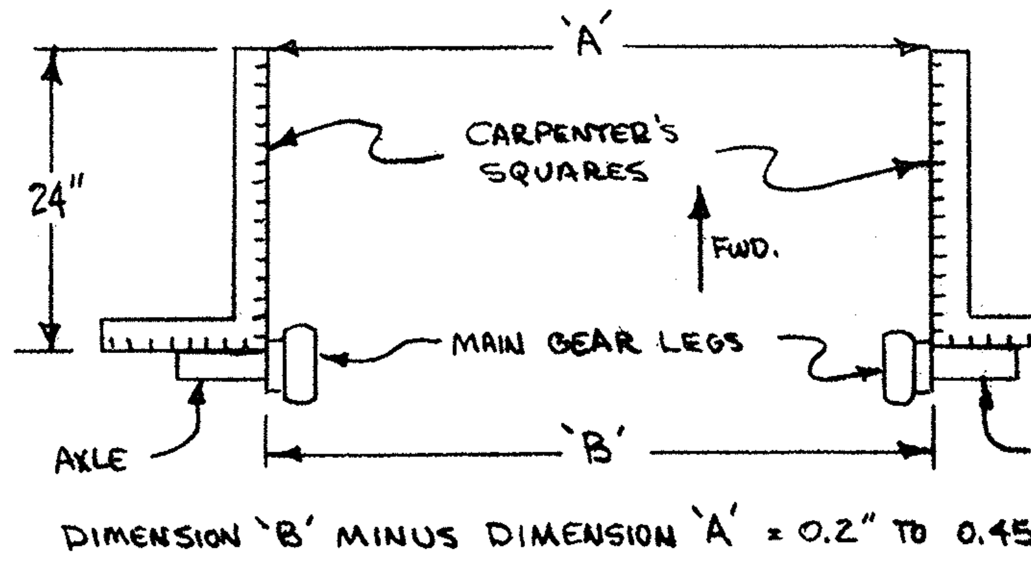
RIGHT SIDE
TEMP. GEAR OPENING



FILL OPENING W/ R45 - SHAPE & COVER WITH 3 PLIES UND @ ORIENT. SHOWN. COVER IN FUSELAGE AREA W/ 2 PLIES BID @ 45°

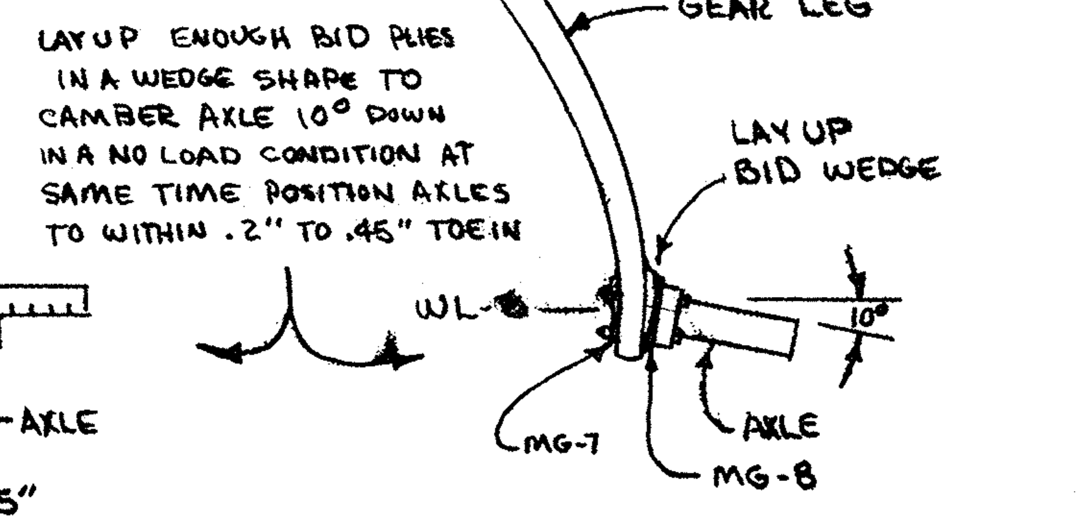

3/16" O.D. X .025 WALL
NYLAFLOW TUBING - 35' REQ.
⅛" OD X .15 WALL X ½" LONG BRASS TUBING - MODEL AIRPLANE TUBING

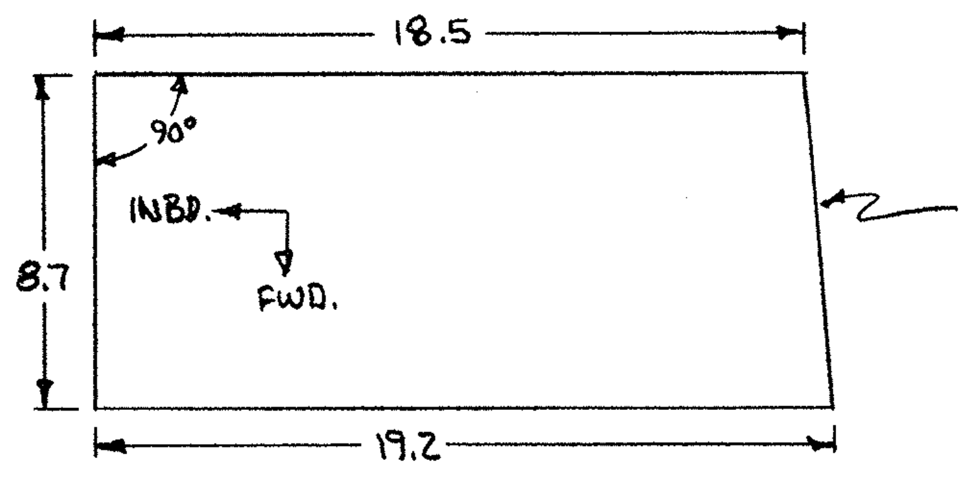




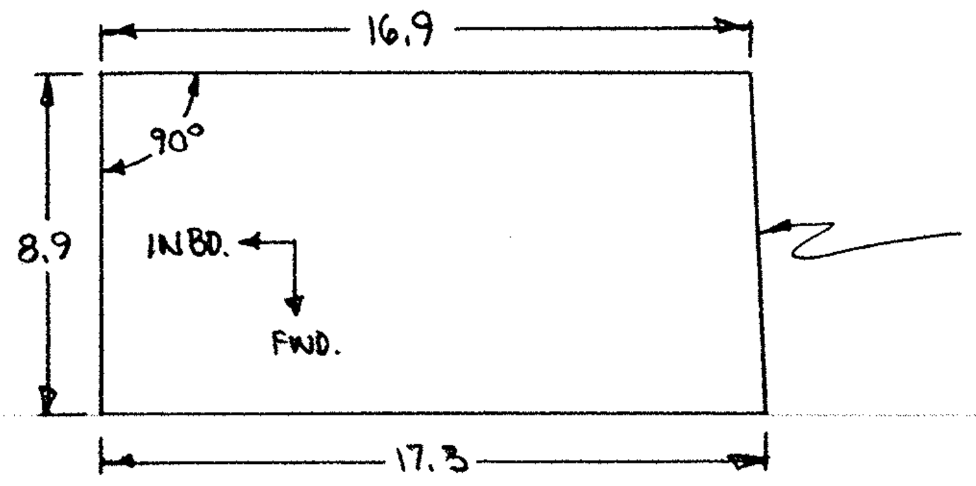
DIMENSION 'B' MINUS DIMENSION 'A' = 0.2" TO 0.45"

LAYUP ENOUGH BID PLIES IN A WEDGE SHAPE TO CAMBER AXLE 10° DOWN IN A NO LOAD CONDITION AT SAME TIME POSITION AXLES TO WITHIN .2" TO .45" TOEIN

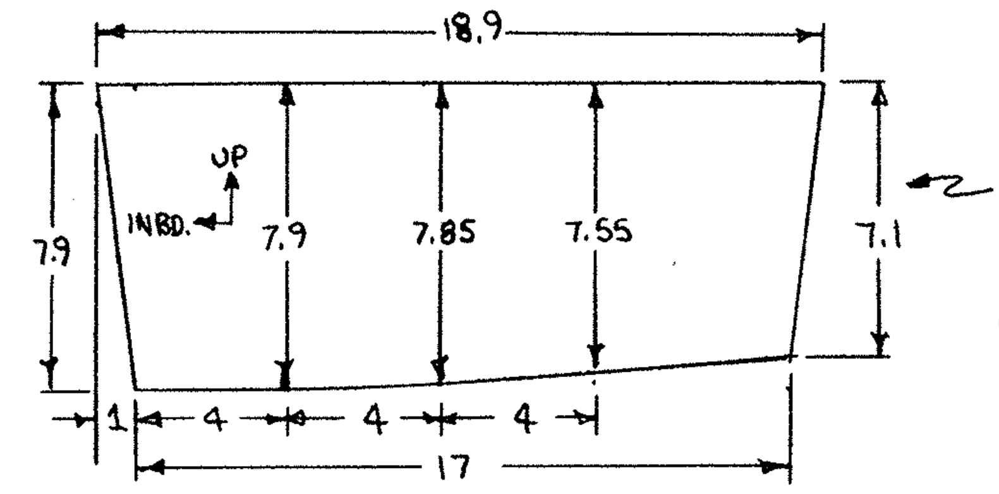




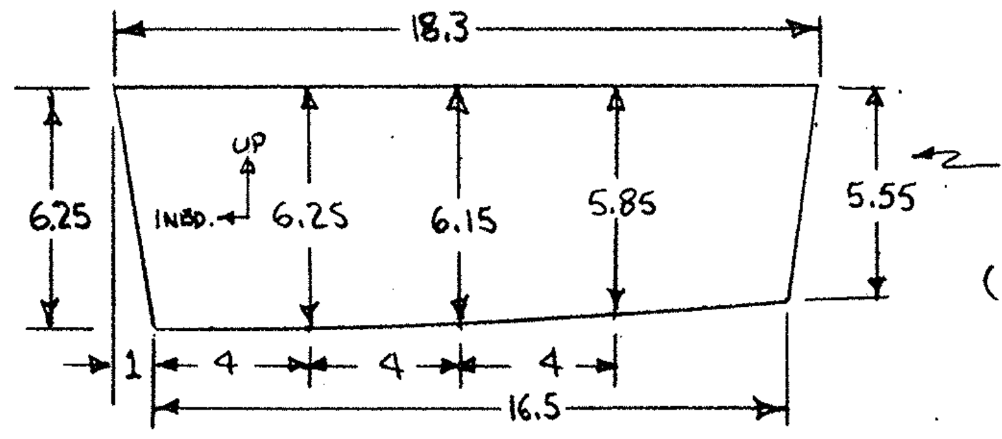
(A) TOP
¼ R45
(MAKE TWO)



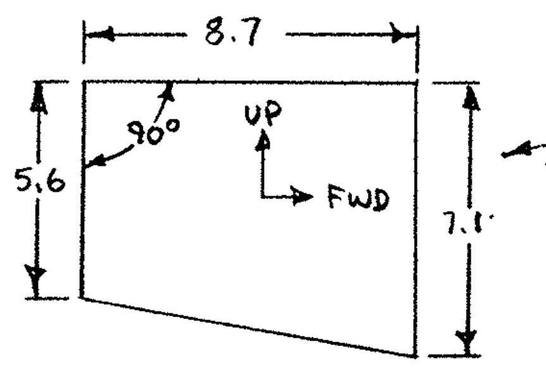
(B) BOTTOM
¼ R45
(MAKE TWO)



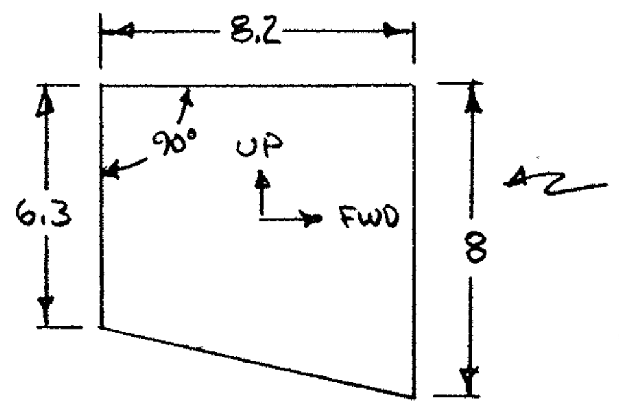
(C) FRONT SIDE
¼ R45
(MAKE TWO)



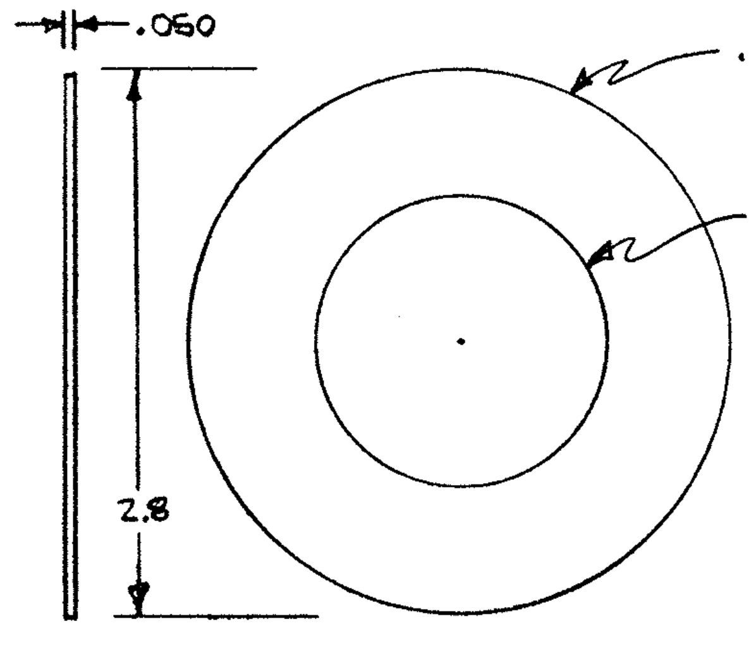
(D) AFT SIDE
¼ R45
(MAKE TWO)



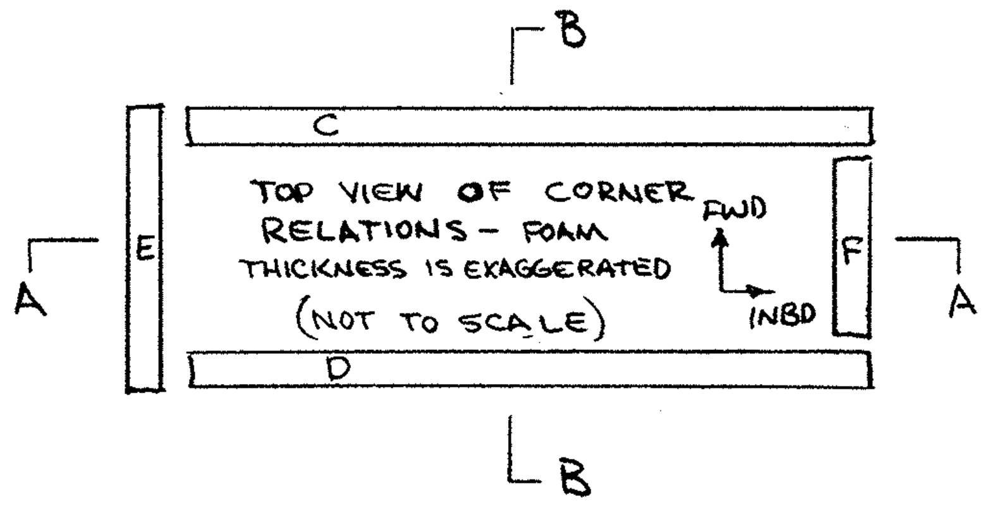
(E) OUTBOARD END
¼ R45
(MAKE TWO)



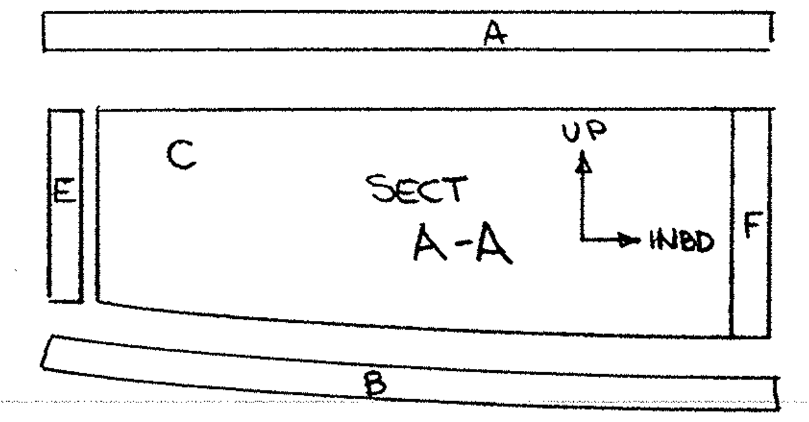
(F) INBOARD END
¼ R45
(MAKE TWO)



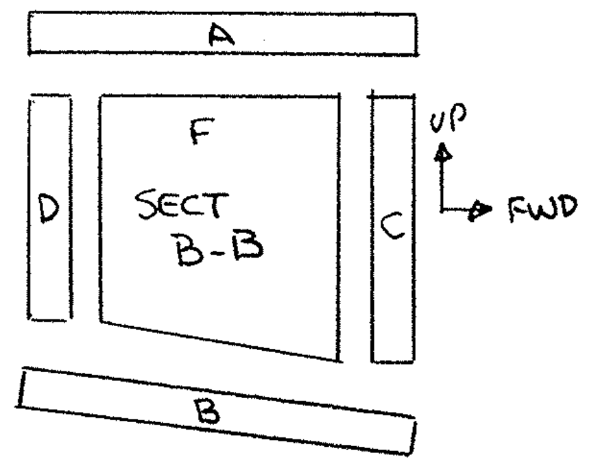
FUE-1
.050 2024-T3 ALUM.
(MAKE TWO)



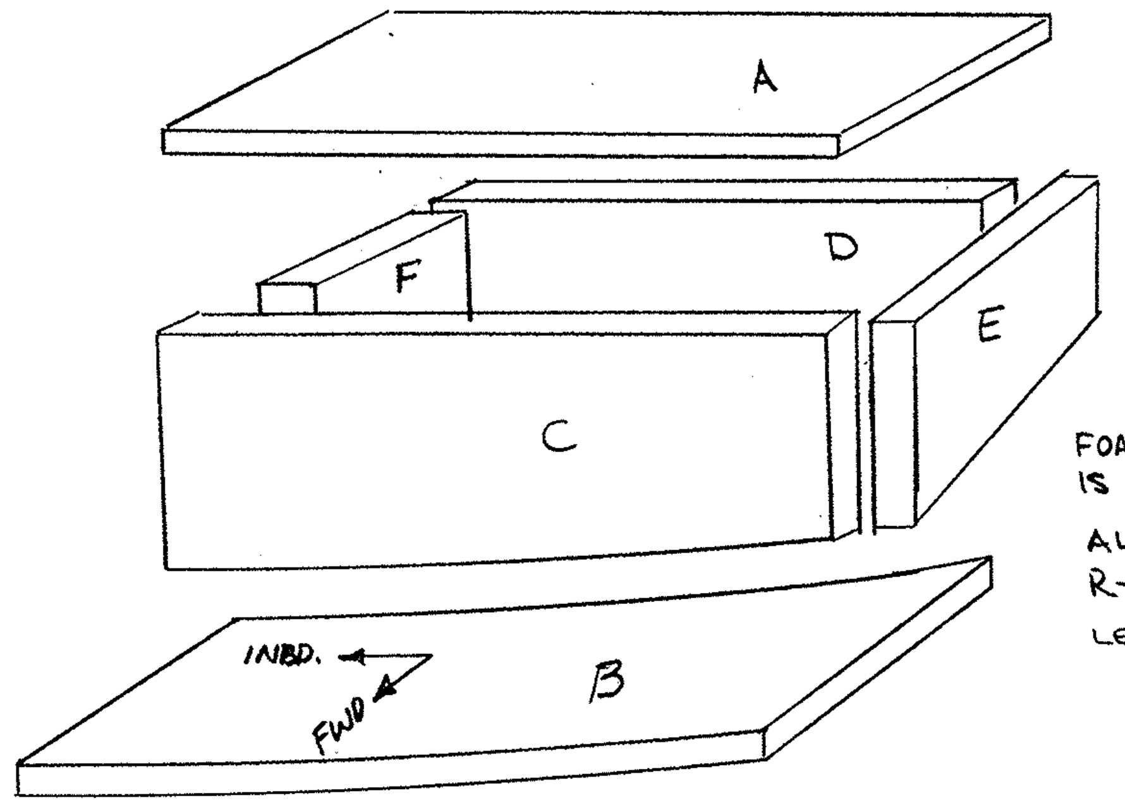
TOP VIEW OF CORNER RELATIONS – FOAM THICKNESS IS EXAGGERATED (NOT TO SCALE)



SECT A-A



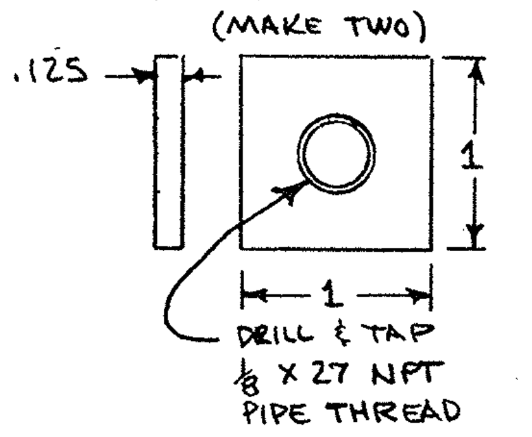
SECT B-B



FOAM THICKNESS IS EXAGGERATED

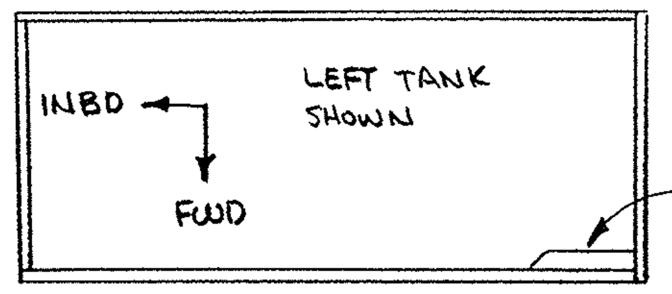
ALL FOAM IS ¼ INCH R-45

LEFT TANK SHOWN



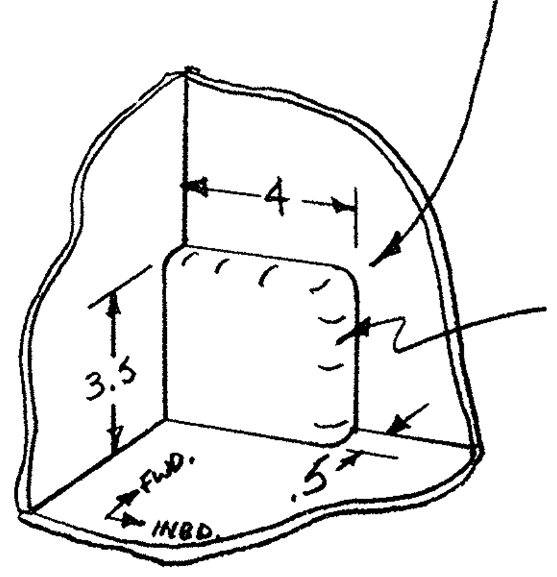
FUE-2
.125 2024-T3 ALUM.
(MAKE TWO)

DRILL & TAP ⅛ X 27 NPT PIPE THREAD

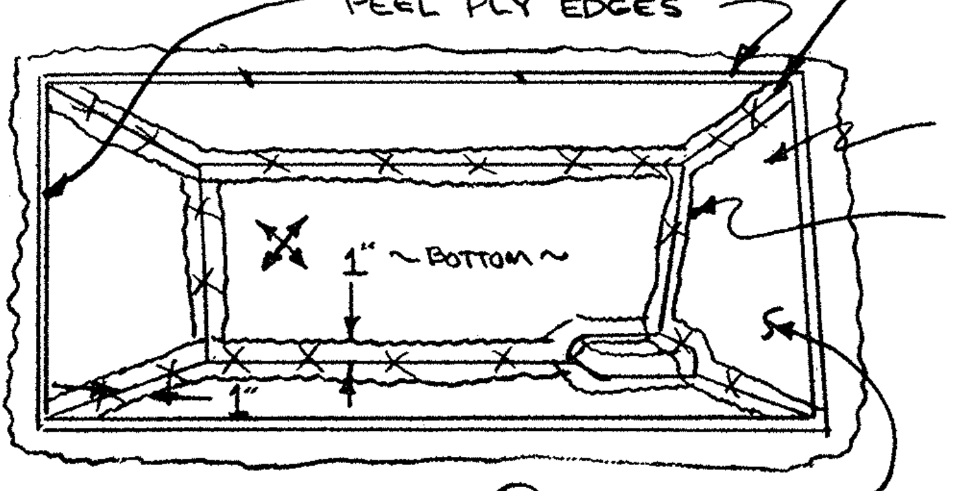


TOP VIEW OF TANK (BOX) WITH SIDES & BOTTOM IN PLACE. ASSEMBLE FOAM WITH HOT GLUE.

INSTALL 4"W X 3.5H X .5T 2lb/FT³ URETHANE IN FWD., OUTBOARD, LOWER CORNER.



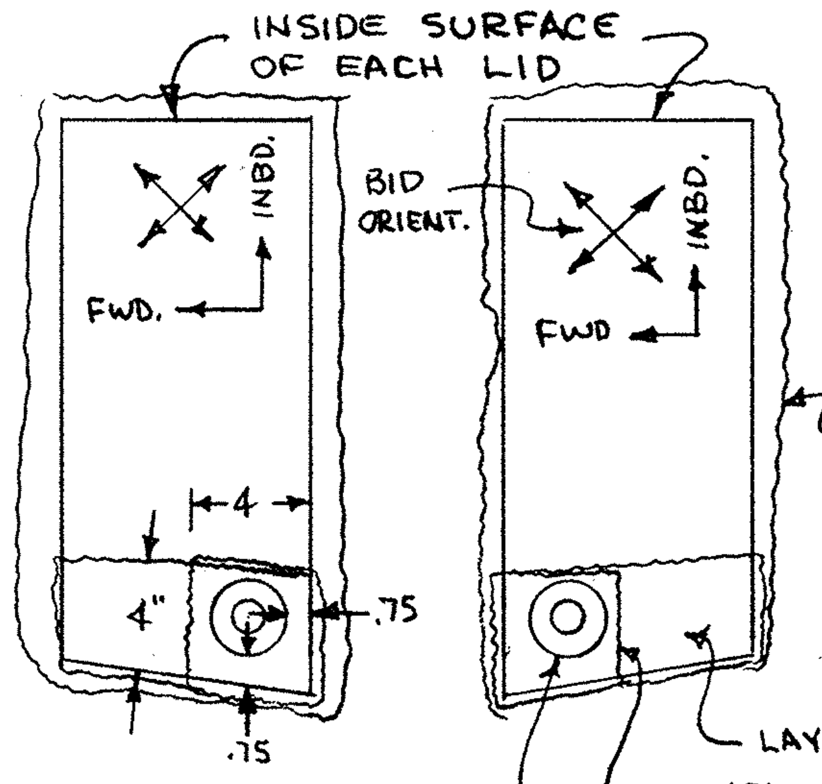
ROUND EDGES OF FOAM



(1A) 1 PLY BID @45° 2" WIDE TAPE (ALL CORNERS & JOINTS)

(1) 1 PLY BID (WET LAYUP)

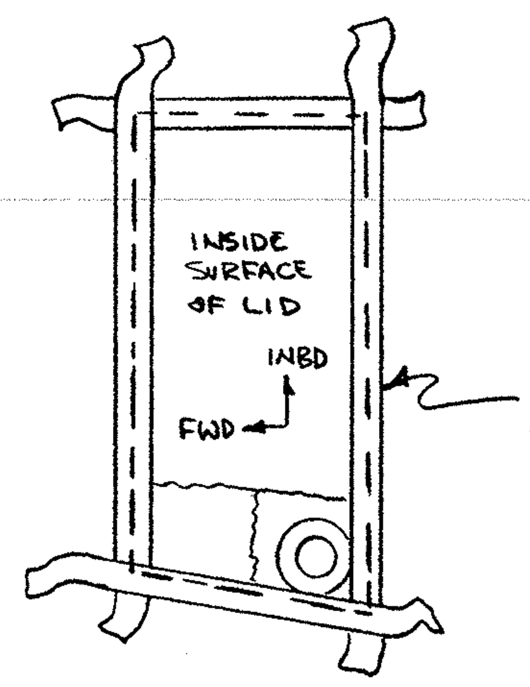
SLURRY ALL FOAM SURFACES INSIDE BOX – PLACE ONE 2" WIDE BID TAPE IN ALL CORNERS AND JOINTS – LAYUP 1 PLY BID @ 45° OVER ENTIRE INSIDE AREA OF BOX. THIS WILL BE A WET LAYUP TO INSURE AGAINST LEAKS. ALLOW SURFACE TO TACK, APPLY PEEL PLY TO TOP EDGES AND TURN UPSIDE DOWN ON SARAN WRAP PROTECTED FLAT SURFACE (NO SCALE)



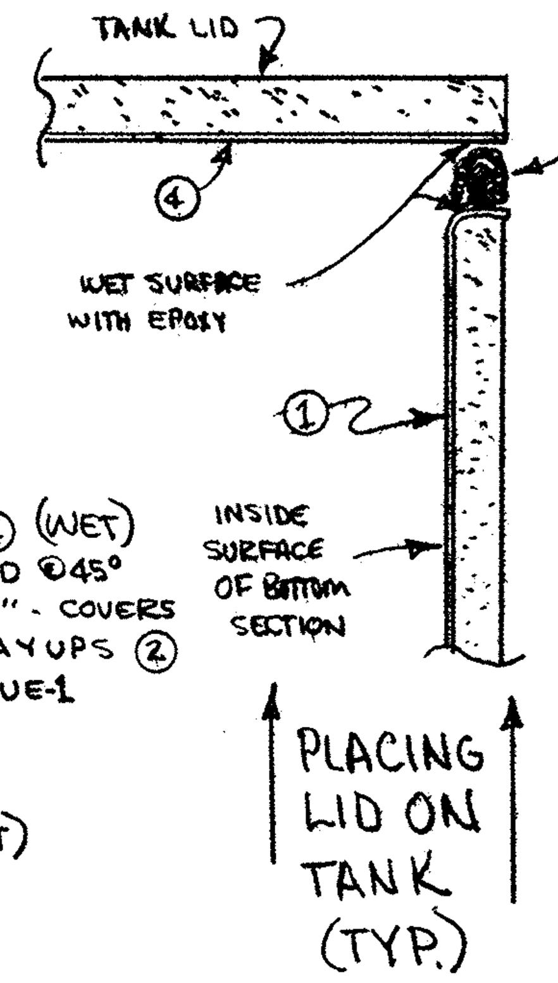
LAYUP ④ (WET) 1 PLY BID @45° 20" X 9" - COVERS ALL OF LAYUPS ② & ③ + FUE-1

LAYUP ② (WET) 1PLY BID @45° 4" X 9"

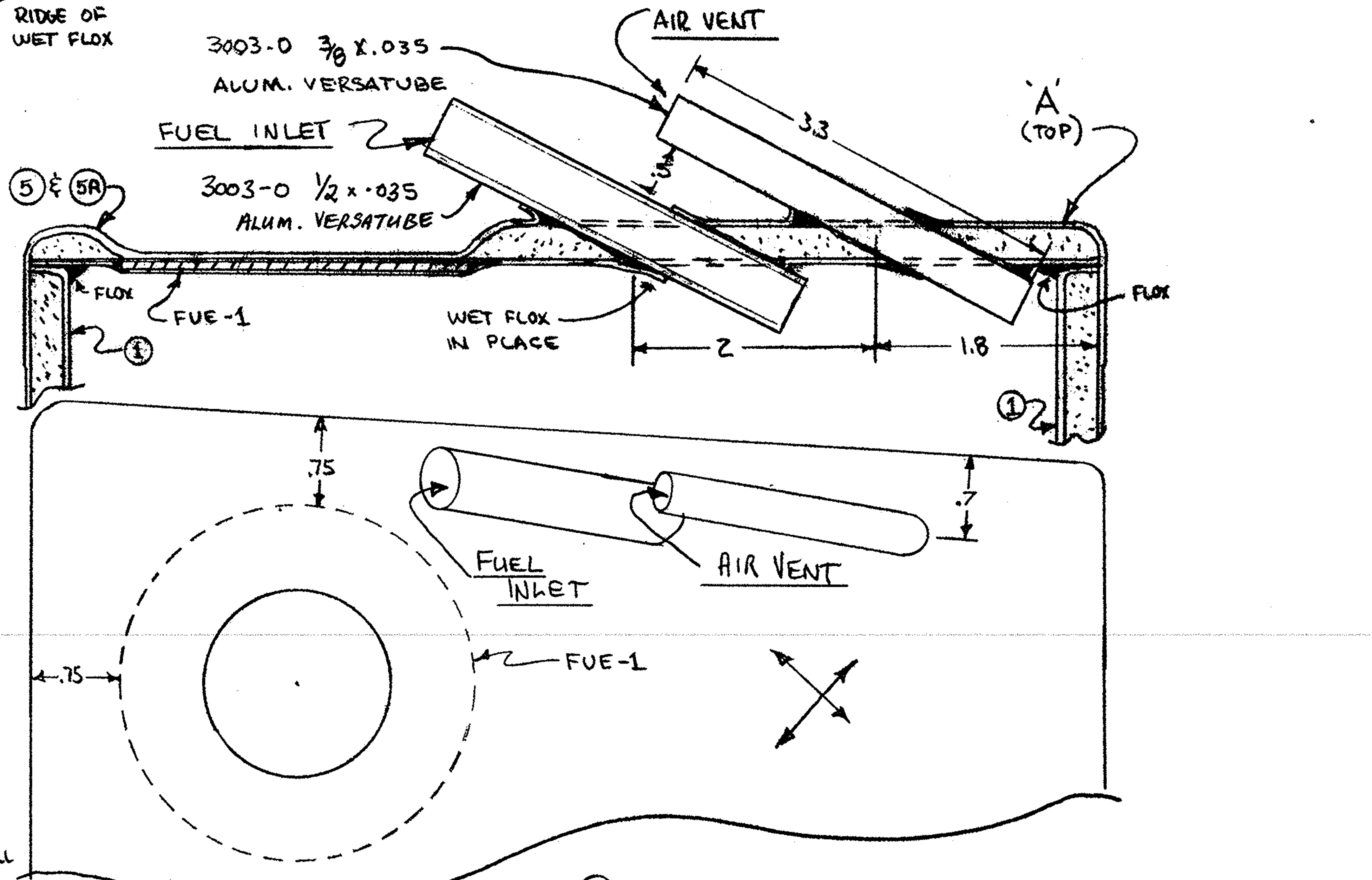
LAYUP ③ (WET) 1 PLY BID @45° 4" X 4" (INSTALL FUE-1 BEFORE DOING LAYUP ④)



PEEL PLY EDGES OF EACH LID

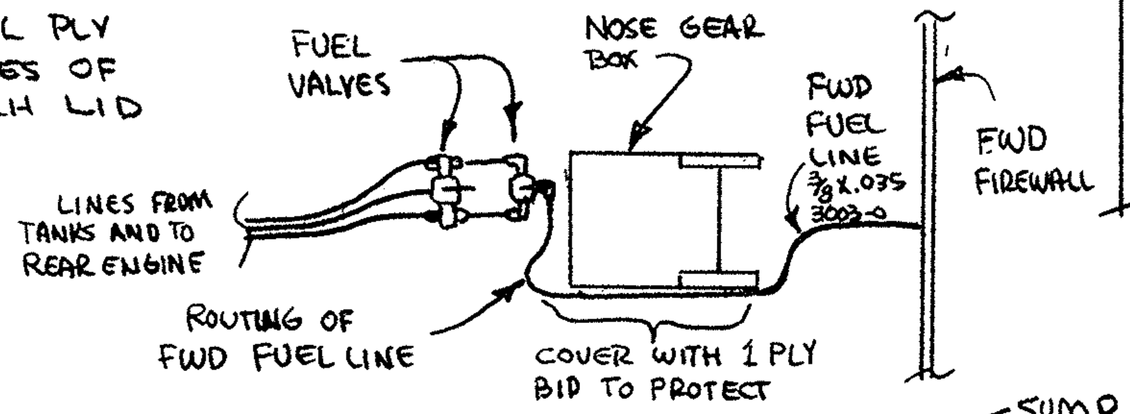


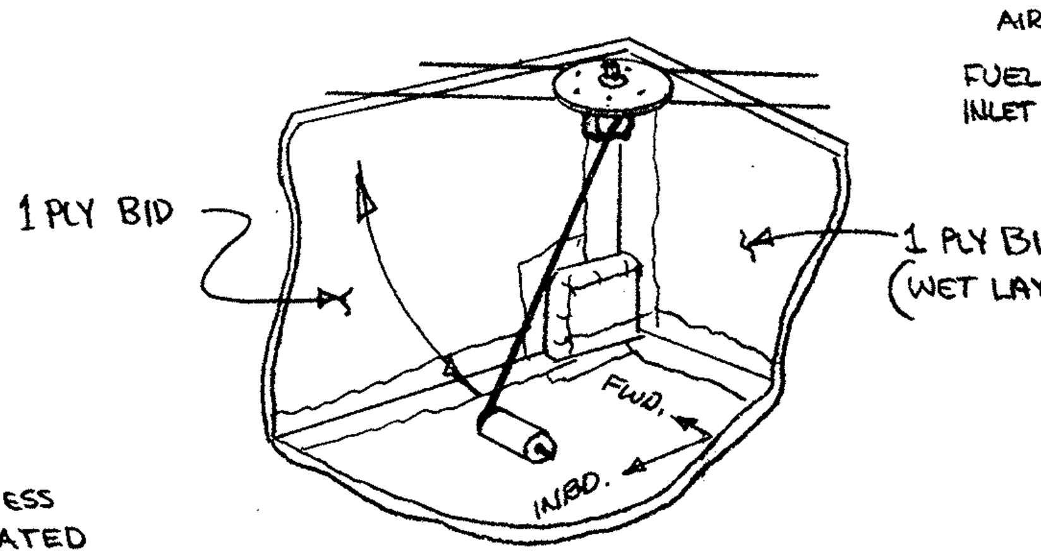
PLACING LID ON TANK (TYP.)



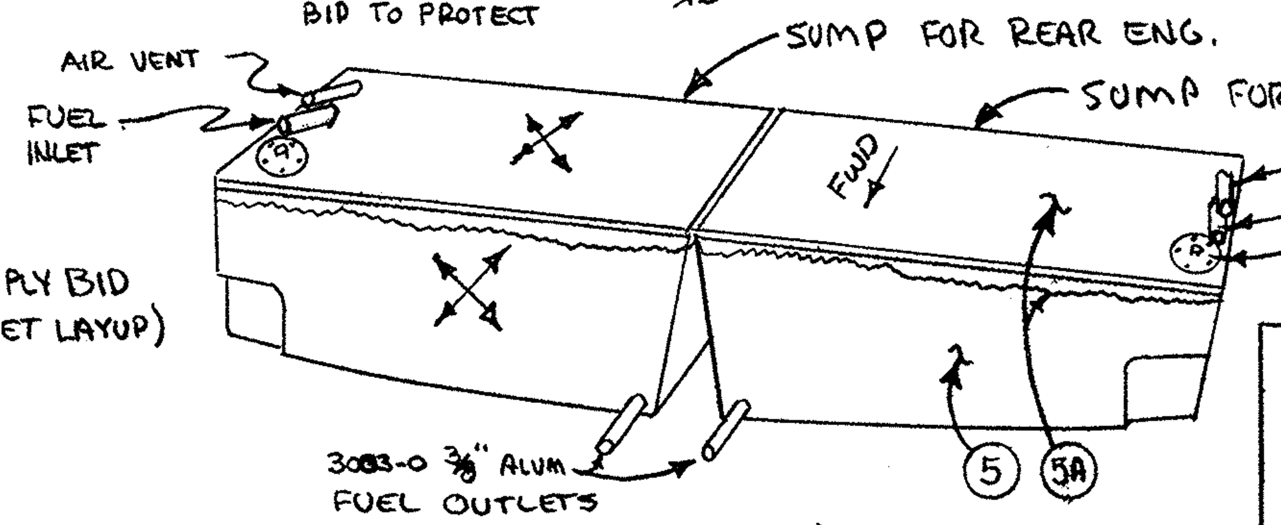
⑤ LAYUP 1 PLY BID @ 45° OVER ENTIRE OUTSIDE SURFACE OF SUMP TANK PLUS –

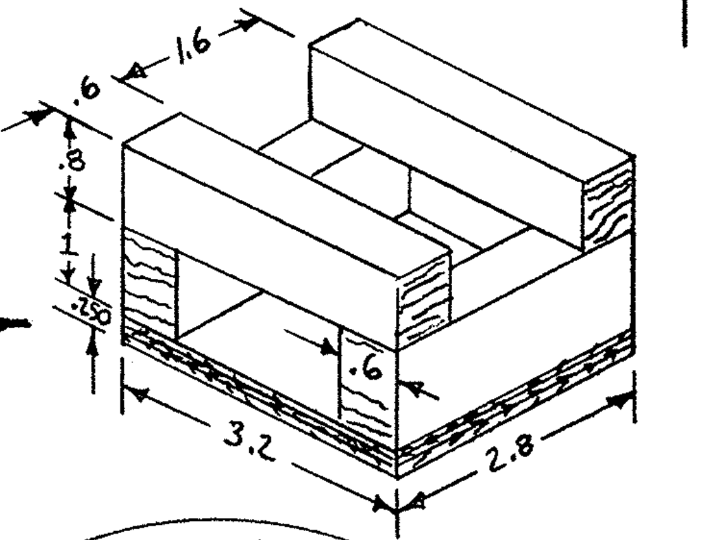
(5A) ADD 1 ADD'L PLY BID TO TOP OF TANK ONLY (THIS IS TO PROTECT FROM TRAFFIC)


FUEL VALVES
NOSE GEAR BOX
FWD FUEL LINE ⅜ X .035 3003-0
FWD FIREWALL
LINES FROM TANKS AND TO REAR ENGINE
ROUTING OF FWD FUEL LINE
COVER WITH 1 PLY BID TO PROTECT

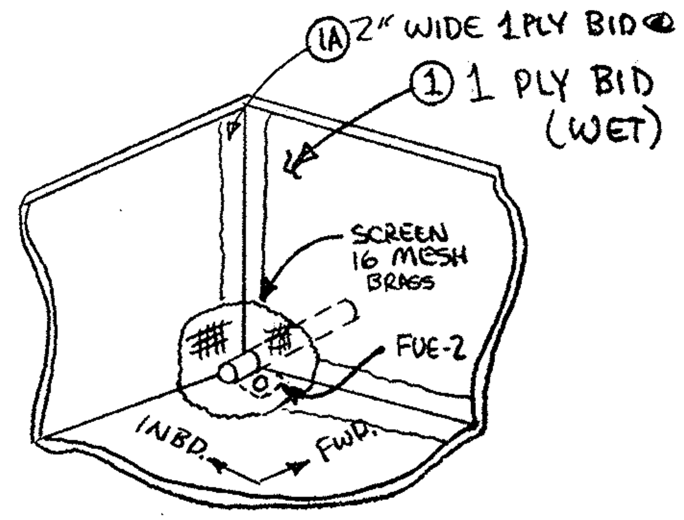


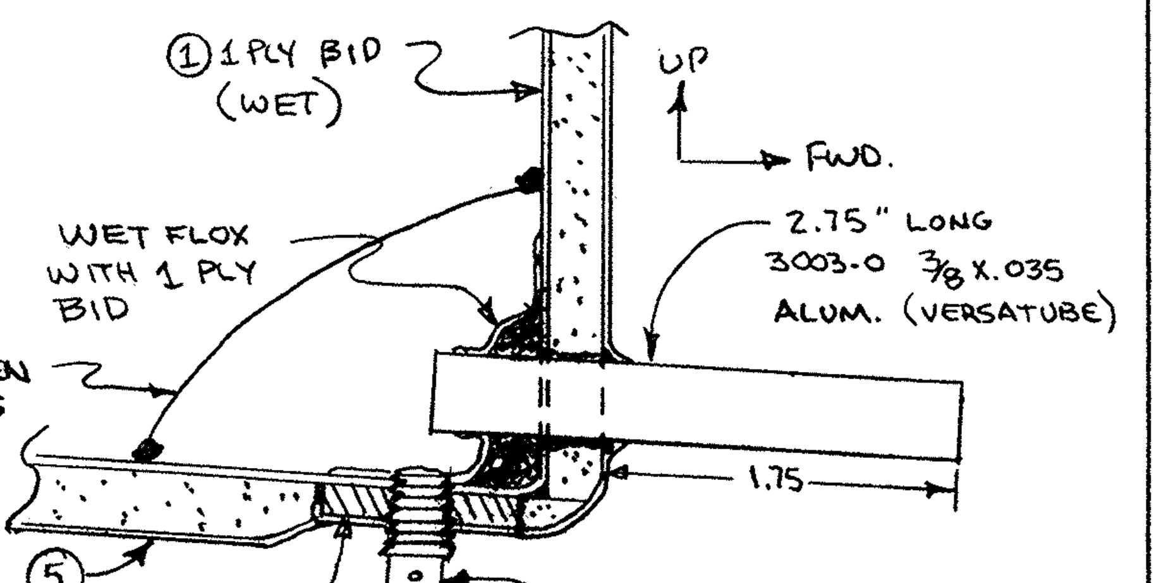
TEMPORARY FUEL SENDER, (ROCHESTER 8341-3) OR EQUIVALENT, IN PLACE AND ADJUST LENGTH OF ARM TO DEPTH OF TANK.


AIR VENT
FUEL INLET
SUMP FOR REAR ENG.
SUMP FOR FRONT ENG
FWD
VENT
FUEL INLET
FUEL SENDER (HELD IN PLACE WITH (5) SHEET METAL SCREWS & RTV SILICONE ON EA. SIDE GASKET)
3003-0 ⅜" ALUM. FUEL OUTLETS
5
5A



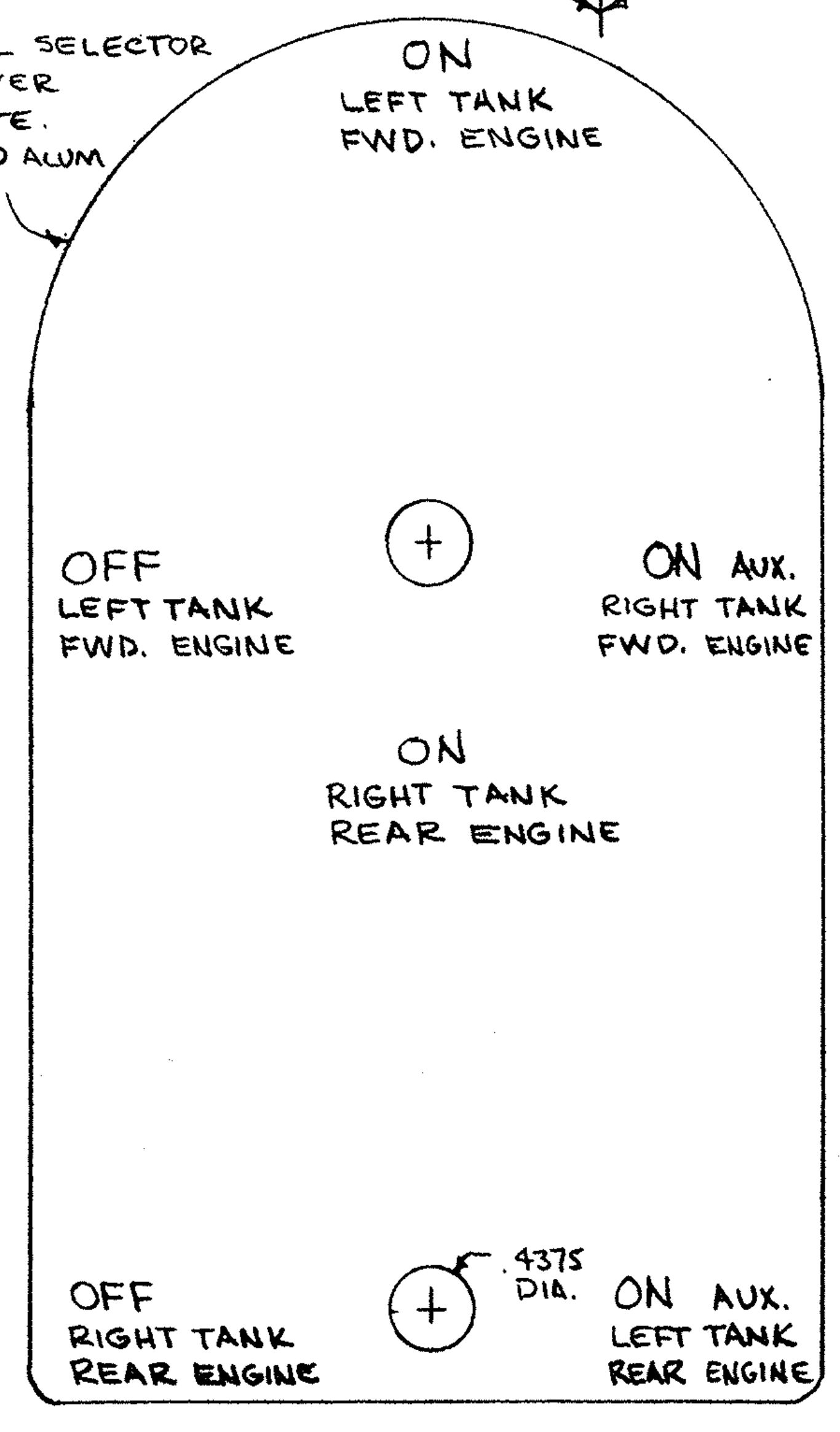
FIXTURE TO HOLD FUEL VALVES ¼" PLYWOOD BASE WITH SPRUCE STACKED PIECES ASSEMBLE WITH EPOXY & PAINT WITH SAME TO PRESERVE



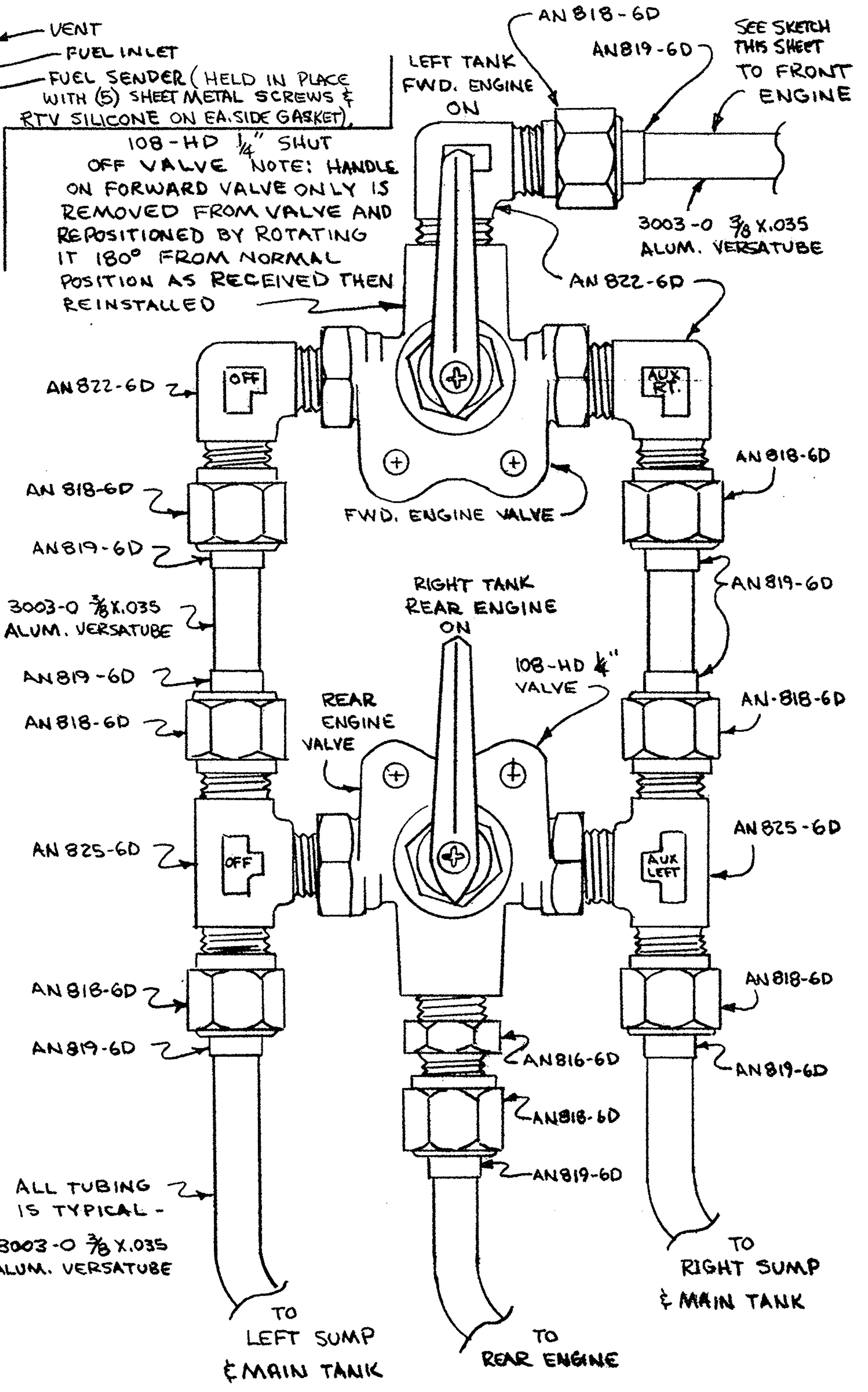


FUE-2 FLOX IN PLACE

INSTALL TEMP. ⅛" NPT PLUG TO KEEP THREADS CLEAN. REPLACE WITH SAF-AIR CAV-110 QUICK DRAIN AFTER TANKS ARE INSTALLED. CUT ¾" HOLES IN BOTTOM OF FUSELAGE - ONE FOR EACH DRAIN


ON LEFT TANK FWD. ENGINE
OFF LEFT TANK FWD. ENGINE
ON AUX. RIGHT TANK FWD. ENGINE
ON RIGHT TANK REAR ENGINE
.4375 DIA.
OFF RIGHT TANK REAR ENGINE
ON AUX. LEFT TANK REAR ENGINE

FUEL SELECTOR COVER PLATE. .020 ALUM



108-HP ¼" SHUT OFF VALVE NOTE: HANDLE ON FORWARD VALVE ONLY IS REMOVED FROM VALVE AND REPOSITIONED BY ROTATING IT 180° FROM NORMAL POSITION AS RECEIVED THEN REINSTALLED

ALL TUBING IS TYPICAL - 3003-0 ⅜ X .035 ALUM. VERSATUBE

MOONEY NOSE GEAR
1/5 SCALE

FRONT VIEW

RIGHT SIDE VIEW

CAUTION!

CHECK FOR POSSIBLE INTERFERENCE BETWEEN NOSE GEAR RETRACT MECHANISM AND THE INSTRUMENT PANEL/RADIO STACK AND OR WIRING BUNDLE.

NOSE GEAR RETRACTION MECHANISM (FULL SCALE)

SIDE VIEW - RUDDER PEDAL & RUDDER ACTUATION MECHANISM (FULL SCALE)

IMPORTANT NOTE
ENTIRE NOSE GEAR, INCLUDING FRONT WHEEL, AND ALL COMPONENTS OF STEERING & RETRACT MECHANISM ARE OFFSET .4" TO LEFT OF AIRCRAFT CENTER LINE OR BL-0

POSITION RUD-4 (BUTT-LINE WISE) AT 90° TO FLAT SURFACE OF RUD-1 PLYWOOD WEDGE COVERED WITH 8 PLIES BID (SEE D-34) THIS WILL GIVE RUDDER A SLIGHT CANT OUTWARD WHICH IS NORMAL

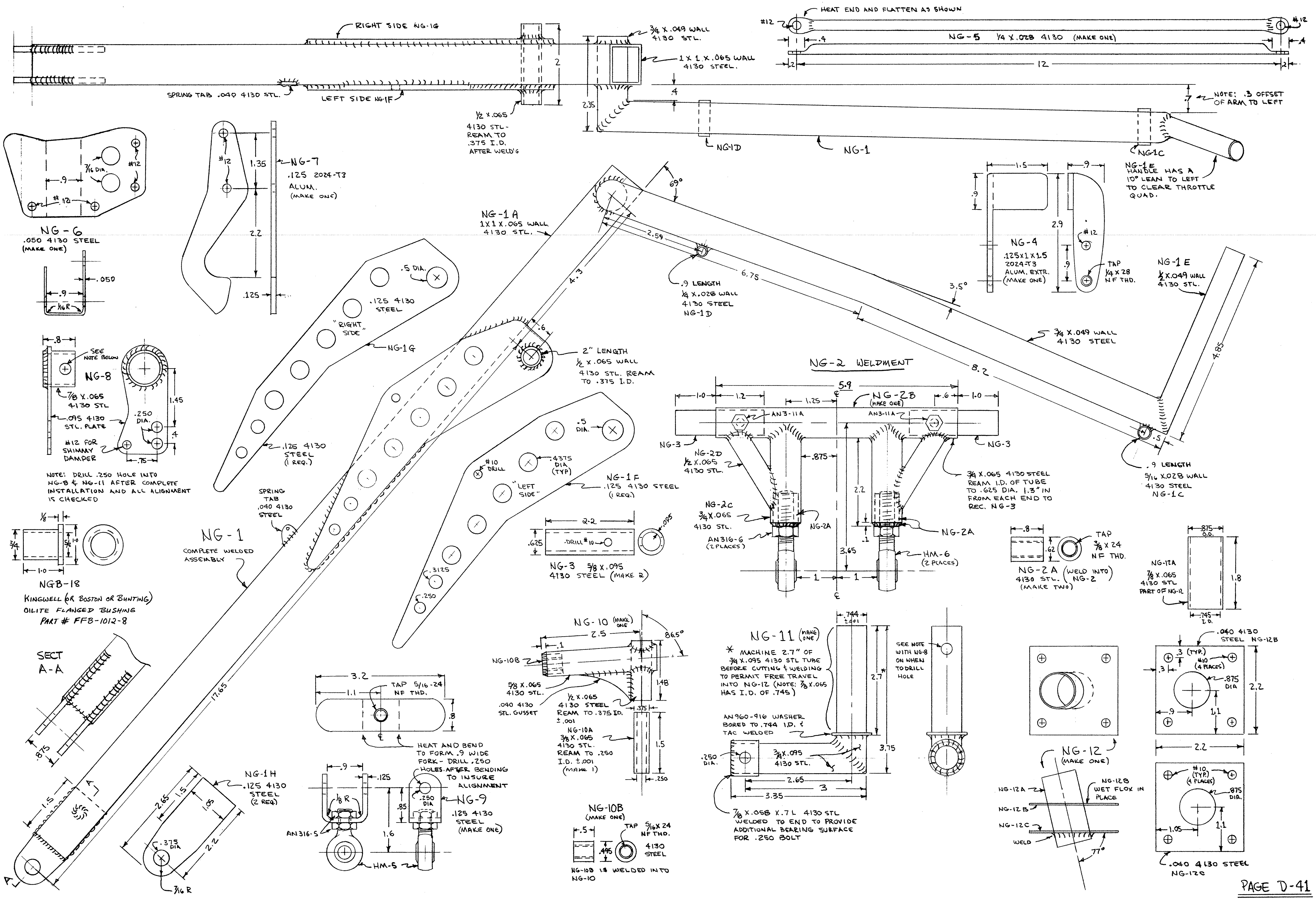
ANGLE OF RUDDER (AFT VIEW)

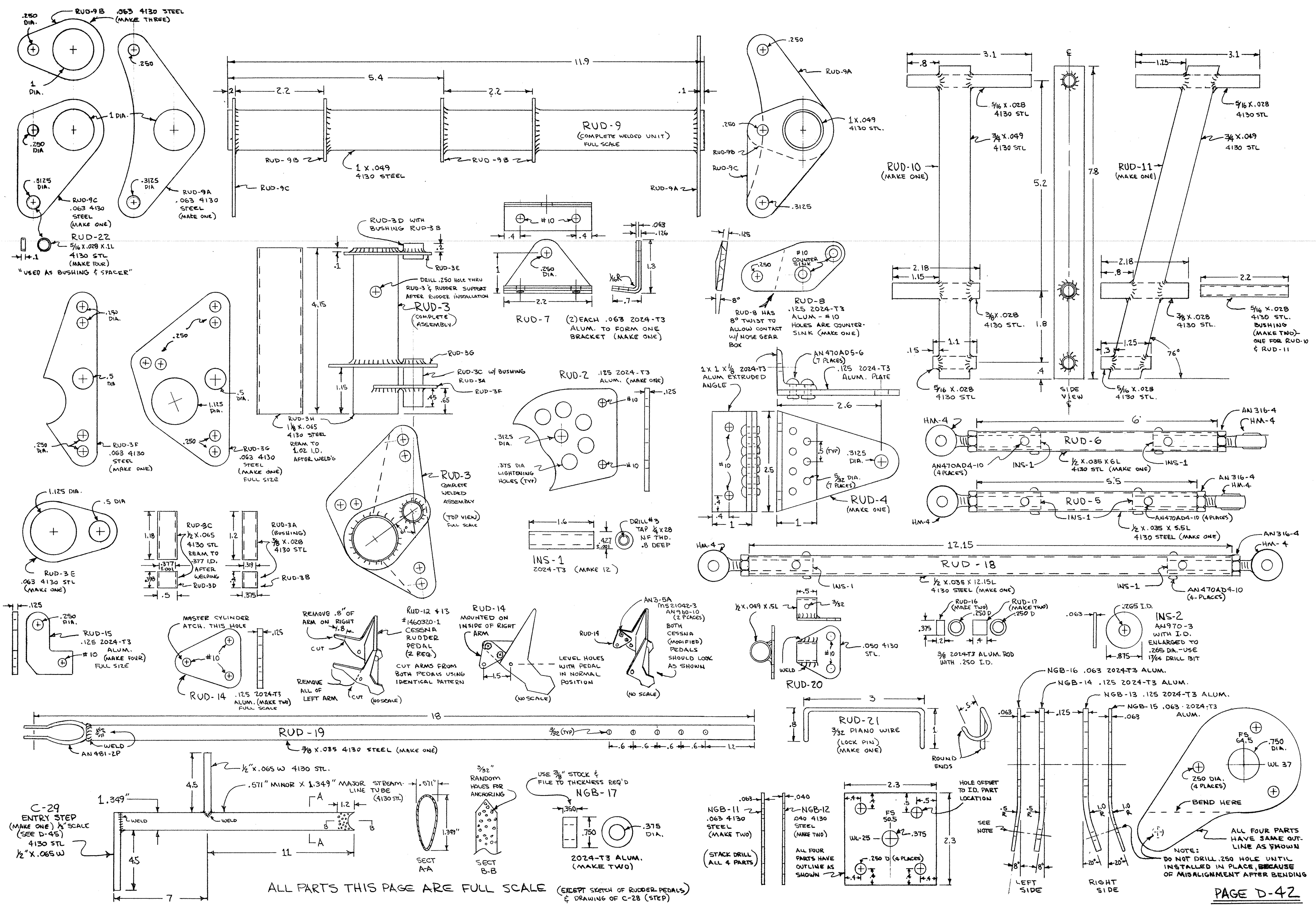
CUSTOM MAKE 4 EA. MASTER CYLINDER BRACKETS (.063 2024-T3 ALUM) TO POSITION CYLINDER PIVOT POINT AT SAME WATER LINE (LEVEL) AS PIVOT POINTS ON RUD-7 & RUD-8

PEDALS ARE NOT SHOWN FOR CLARITY

VIEW LOOKING FWD.

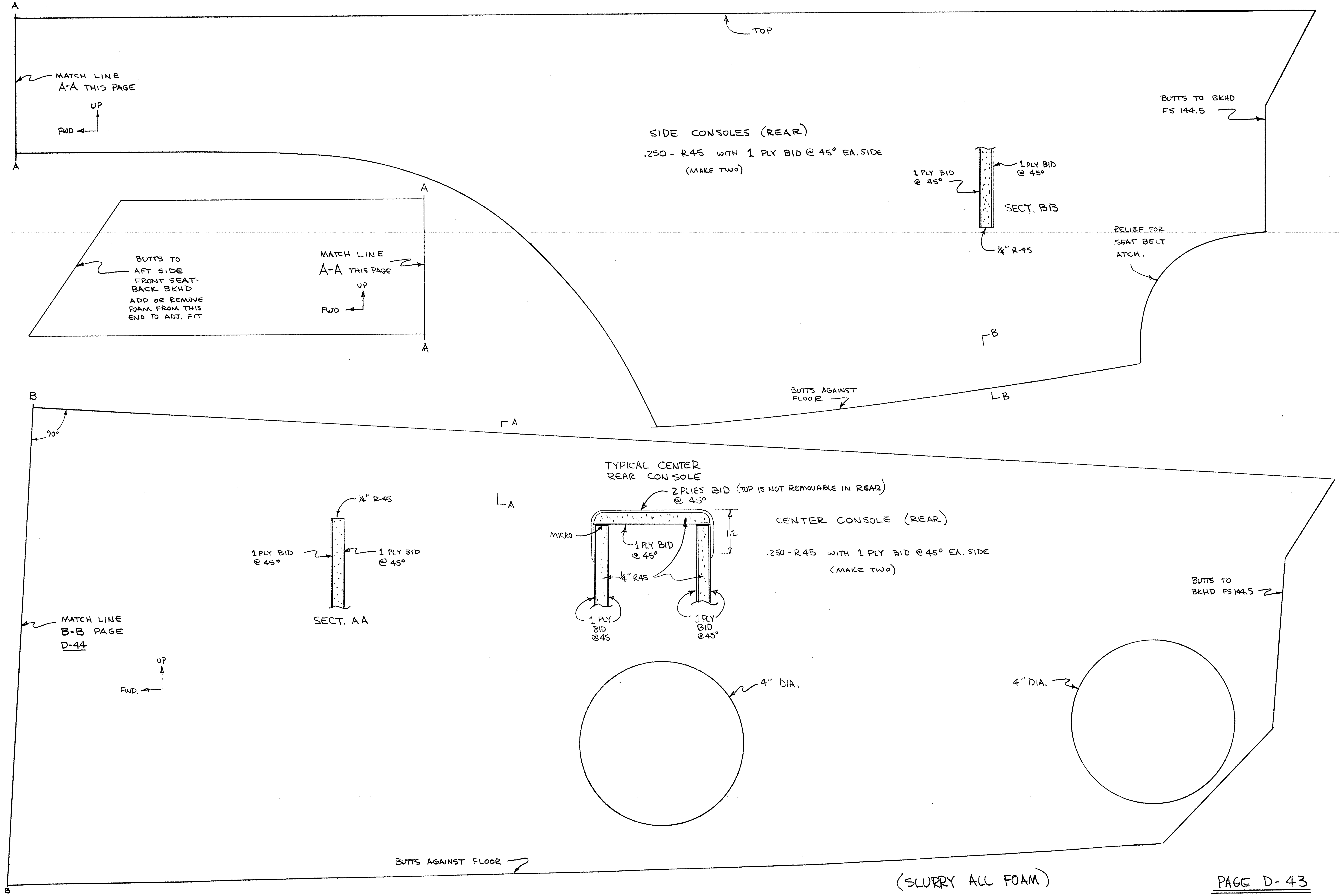
SEE NOTE ON TOP VIEW


RIGHT SIDE NG-1G
SPRING TAB .040 4130 STL.
LEFT SIDE NG-1F
2
½ X .065
4130 STL-
REAM TO
.375 I.D.
AFTER WELD'G
¾ X .049 WALL
4130 STL.
1 X 1 X .065 WALL
4130 STEEL.
2.35
.4
NG-1D
NG-1
.7
NOTE: .3 OFFSET
OF ARM TO LEFT
NG-1C
NG-1E
HANDLE HAS A
10° LEAN TO LEFT
TO CLEAR THROTTLE
QUAD.
HEAT END AND FLATTEN AS SHOWN
#12
#12
NG-5 ¼ X .028 4130 (MAKE ONE)
.4
.4
.2
12
.2
7/16 DIA.
#12
.9
#12
NG-6
.050 4130 STEEL
(MAKE ONE)
.050
.9
1/16 R
#12
1.35
2.2
.125
NG-7
.125 2024-T3
ALUM.
(MAKE ONE)
NG-1A
1 X 1 X .065 WALL
4130 STL.
69°
2.59
.9 LENGTH
¼ X .028 WALL
4130 STEEL
NG-1D
6.75
4.3
3.5°
8.2
¾ X .049 WALL
4130 STEEL
1.5
.9
.9
2.9
NG-4
.125 X 1 X 1.5
2024-T3
ALUM. EXTR.
(MAKE ONE)
#12
.9
TAP
¼ X 28
NF THD.
NG-1E
½ X .049 WALL
4130 STL.
4.85
.5
.9 LENGTH
5/16 X .028 WALL
4130 STEEL
NG-1C
.5 DIA.
.125 4130
STEEL
"RIGHT SIDE"
NG-1G
.6
2" LENGTH
½ X .065 WALL
4130 STL. REAM
TO .375 I.D.
.125 4130
STEEL
(1 REQ.)
.8
SEE NOTE BELOW
NG-8
7/8 X .065
4130 STL
.095 4130
STL. PLATE
1.45
.250
DIA.
.4
#12 FOR
SHIMMY
DAMPER
.75
NOTE: DRILL .250 HOLE INTO
NG-8 & NG-11 AFTER COMPLETE
INSTALLATION AND ALL ALIGNMENT
IS CHECKED
.5
DIA.
#10
DRILL
.4375
DIA
(TYP)
"LEFT SIDE"
NG-1F
.125 4130 STEEL
(1 REQ.)
.3125
.250
SPRING
TAB
.040 4130
STEEL
NG-1
COMPLETE WELDED
ASSEMBLY
1/8
¾
5/8
1.0
1.0
NGB-18
KINGWELL (OR BOSTON OR BUNTING)
OILITE FLANGED BUSHING
PART # FFB-1012-8
SECT
A-A
.875
17.65
1.5
A
A
NG-1H
.125 4130
STEEL
(2 REQ)
2.65
1.5
1.85
2.2
.375
DIA
3/16 R
2.2
.625
DRILL #10
.095
NG-3 5/8 X .095
4130 STEEL (MAKE 2)
NG-2 WELDMENT
5.9
1.0
1.2
1.25
℄
NG-2B
(MAKE ONE)
.6
1.0
AN3-11A
AN3-11A
NG-3
NG-3
NG-2D
½ X .065
4130 STL.
.875
2.2
¾ X .065 4130 STEEL
REAM I.D. OF TUBE
TO .625 DIA. 1.3" IN
FROM EACH END TO
REC. NG-3
NG-2C
¾ X .065
4130 STL.
NG-2A
AN316-6
(2 PLACES)
.1
NG-2A
3.65
HM-6
(2 PLACES)
1
1
℄
.8
.62
TAP
3/8 X 24
NF THD.
NG-2A (WELD INTO NG-2)
4130 STL.
(MAKE TWO)
.875
O.D.
NG-12A
7/8 X .065
4130 STL
PART OF NG-12
1.8
.745
I.D.
NG-10 (MAKE ONE)
2.5
86.5°
.1
NG-10B
5/8 X .065
4130 STL.
.040 4130
STL. GUSSET
½ X .065
4130 STEEL
REAM TO .375 I.D.
±.001
1.48
.375
NG-10A
3/8 X .065
4130 STL.
REAM TO .250
I.D. ±.001
(MAKE 1)
1.5
.250
NG-10B
(MAKE ONE)
.5
.495
TAP 5/16 X 24
NF THD.
4130
STEEL
NG-10B IS WELDED INTO
NG-10
3.2
1.1
TAP 5/16-24
NF THD.
.8
℄
HEAT AND BEND
TO FORM .9 WIDE
FORK - DRILL .250
HOLES AFTER BENDING
TO INSURE
ALIGNMENT
.9
.125
1/8 R
.85
1.6
.250
DIA
AN316-5
HM-5
NG-9
.125 4130
STEEL
(MAKE ONE)
NG-11 (MAKE ONE)
* MACHINE 2.7" OF
¾ X .095 4130 STL TUBE
BEFORE CUTTING & WELDING
TO PERMIT FREE TRAVEL
INTO NG-12 (NOTE: 7/8 X .065
HAS I.D. OF .745)
.744
±.001
2.7*
SEE NOTE
WITH NG-8
ON WHEN
TO DRILL
HOLE
AN960-916 WASHER
BORED TO .744 I.D. &
TAC WELDED
.250
DIA.
¾ X .095
4130 STL.
3.75
2.65
3
3.35
7/8 X .058 X .7 L 4130 STL
WELDED TO END TO PROVIDE
ADDITIONAL BEARING SURFACE
FOR .250 BOLT
NG-12
(MAKE ONE)
NG-12A
NG-12B
NG-12C
WELD
NG-12B
WET FLOX IN
PLACE
77°
.040 4130
STEEL NG-12B
.3 (TYP.)
#10
(4 PLACES)
.3
.875
DIA
2.2
.9
1.1
2.2
#10
(TYP.)
(4 PLACES)
.875
DIA.
1.05
1.1
.040 4130 STEEL
NG-12C



.250 DIA.
RUD-9B .063 4130 STEEL (MAKE THREE)
1 DIA.
.250
1 DIA.
.250 DIA
.3125 DIA.
RUD-9C .063 4130 STEEL (MAKE ONE)
.3125 DIA
RUD-9A .063 4130 STEEL (MAKE ONE)
RUD-22 5/16 X.028 X.1L 4130 STL (MAKE FOUR)
.1
"USED AS BUSHING & SPACER"
11.9
5.4
.2
2.2
2.2
.1
RUD-9 (COMPLETE WELDED UNIT) FULL SCALE
RUD-9B
1 X.049 4130 STEEL
RUD-9B
RUD-9C
RUD-9A
.250
RUD-9A
.250
1 X.049 4130 STL.
RUD-9B
RUD-9C
.3125
3.1
.8
5/16 X.028 4130 STL
3/4 X.049 4130 STL
RUD-10 (MAKE ONE)
2.18
1.15
3/8 X.028 4130 STL.
1.1
.15
5/16 X.028 4130 STL
5.2
7.8
1.8
.4
SIDE VIEW
3.1
1.25
5/16 X.028 4130 STL
3/4 X.049 4130 STL
RUD-11 (MAKE ONE)
2.18
.8
3/8 X.028 4130 STL.
.3
1.25
76°
5/16 X.028 4130 STL.
2.2
5/16 X.028 4130 STL. BUSHING (MAKE TWO) - ONE FOR RUD-10 & RUD-11
RUD-3D WITH BUSHING RUD-3B
.2
.1
RUD-3E
4.15
DRILL .250 HOLE THRU RUD-3 & RUDDER SUPPORT AFTER RUDDER INSTALLATION
RUD-3 (COMPLETE ASSEMBLY)
RUD-3G
RUD-3C W/ BUSHING RUD-3A
1.15
RUD-3F
.45
.65
RUD-3H 1 1/8 X.065 4130 STEEL REAM TO 1.02 I.D. AFTER WELD'G
#10
.4
.4
1
.250 DIA.
2.2
RUD-7
(2) EACH .063 2024-T3 ALUM. TO FORM ONE BRACKET (MAKE ONE)
.063
.126
1.3
1/16 R
.7
.125
8°
RUD-8 HAS 8° TWIST TO ALLOW CONTACT W/ NOSE GEAR BOX
.250
#10 COUNTER SINK
RUD-8 .125 2024-T3 ALUM. - #10 HOLES ARE COUNTER-SINK (MAKE ONE)
.250 DIA.
.250
.5 DIA
.250 DIA.
RUD-3F .063 4130 STEEL (MAKE ONE)
.5 DIA.
1.125 DIA.
.250
RUD-3G .063 4130 STEEL (MAKE ONE) FULL SIZE
RUD-2 .125 2024-T3 ALUM. (MAKE ONE)
#10
.125
.3125 DIA.
.375 DIA LIGHTENING HOLES (TYP)
#10
1 X 1 X 1/8 2024-T3 ALUM EXTRUDED ANGLE
AN470AD5-6 (7 PLACES)
.125 2024-T3 ALUM. PLATE
2.6
#10
2.5
.5 (TYP)
.3125 DIA.
5/32 DIA. (7 PLACES)
RUD-4 (MAKE ONE)
.4
.4
1
1
RUD-3 COMPLETE WELDED ASSEMBLY (TOP VIEW) FULL SCALE
61°
1.6
INS-1 2024-T3 (MAKE 12)
.427 ±.001
DRILL #3 TAP 1/4 X 28 NF THD. .8 DEEP
HM-4
6'
AN316-4 HM-4
RUD-6
AN470AD4-10 (4 PLACES)
INS-1
1/2 X.035 X 6L 4130 STL (MAKE ONE)
INS-1
5.5
AN316-4 HM-4
RUD-5
HM-4
INS-1
AN470AD4-10 (4 PLACES)
1/2 X.035 X 5.5L 4130 STEEL (MAKE ONE)
1.125 DIA.
.5 DIA
RUD-3E .063 4130 STL (MAKE ONE)
1.18
RUD-3C 1/2 X.065 4130 STL REAM TO .377 I.D. AFTER WELDING
.377 ±.001
.319
.398
RUD-3D
.5
1.2
RUD-3A (BUSHING) 5/8 X.028 4130 STL
.319
.4
RUD-3B
.375
HM-4
12.15
AN316-4 HM-4
RUD-18
INS-1
1/2 X.035 X 12.15L 4130 STEEL (MAKE ONE)
INS-1
AN470AD4-10 (4-PLACES)
.125
.250 DIA.
RUD-15 .125 2024-T3 ALUM.
#10 (MAKE FOUR) FULL SIZE
MASTER CYLINDER ATCH. THIS HOLE
#10
.125
RUD-14
.125 2024-T3 ALUM. (MAKE TWO) FULL SCALE
REMOVE .8" OF ARM ON RIGHT
.8
CUT
REMOVE ALL OF LEFT ARM
CUT
(NO SCALE)
RUD-12 & 13 #1460320-1 CESSNA RUDDER PEDAL (2 REQ.)
CUT ARMS FROM BOTH PEDALS USING IDENTICAL PATTERN
RUD-14 MOUNTED ON INSIDE OF RIGHT ARM
1.5
LEVEL HOLES WITH PEDAL IN NORMAL POSITION
(NO SCALE)
RUD-14
AN3-5A MS21042-3 AN960-10 (2 PLACES)
BOTH CESSNA (MODIFIED) PEDALS SHOULD LOOK AS SHOWN
(NO SCALE)
1/2 X.049 X.5L
.5
3/32
.050 4130 STL.
#10
WELD
RUD-20
RUD-16 (MAKE TWO) .250 D
RUD-17 (MAKE TWO) .250 D
.375
.2
.4
3/8 2024-T3 ALUM. ROD WITH .250 I.D.
.063
.265 I.D.
INS-2 AN970-3 WITH I.D. ENLARGED TO .265 DIA. - USE 17/64 DRILL BIT
.875
18
RUD-19
3/32 (TYP)
.6
.6
.6
.6
1.2
WELD
AN481-2P
3/8 X.035 4130 STEEL (MAKE ONE)
3
RUD-21 3/32 PIANO WIRE (LOCK PIN) (MAKE ONE)
.8
1
.5
ROUND ENDS
NGB-16 .063 2024-T3 ALUM.
NGB-14 .125 2024-T3 ALUM.
NGB-13 .125 2024-T3 ALUM.
NGB-15 .063 2024-T3 ALUM.
.063
.125
.063
FS 64.5
.750 DIA.
WL 37
.250 DIA. (4 PLACES)
BEND HERE
ALL FOUR PARTS HAVE SAME OUTLINE AS SHOWN
NOTE: DO NOT DRILL .250 HOLE UNTIL INSTALLED IN PLACE, BECAUSE OF MISALIGNMENT AFTER BENDING
.5 R
.5 R
1.0 R
1.0 R
8°
8°
20°
20°
LEFT SIDE
RIGHT SIDE
SEE NOTE
C-29 ENTRY STEP (MAKE ONE) 1/2" SCALE (SEE D-45) 4130 STL 1/2" X.065 W
1.349"
4.5
1/2" X.065 W 4130 STL.
.571" MINOR X 1.349" MAJOR STREAM-LINE TUBE (4130 STL)
A
1.2
WELD
WELD
B
B
A
11
4.5
7
.571"
1.349"
SECT A-A
3/32" RANDOM HOLES FOR ANCHORING
SECT B-B
USE 3/8" STOCK & FILE TO THICKNESS REQ'D
NGB-17
.350
.750
.375 DIA.
2024-T3 ALUM. (MAKE TWO)
.063
.040
NGB-11 .063 4130 STEEL (MAKE TWO)
NGB-12 .040 4130 STEEL (MAKE TWO)
(STACK DRILL ALL 4 PARTS)
ALL FOUR PARTS HAVE OUTLINE AS SHOWN
2.3
.4
.5
.5
FS 50.5
WL-25
.375
.250 D (4 PLACES)
2.3
.4
.4
.4
.4
HOLE OFFSET TO I.D. PART LOCATION

ALL PARTS THIS PAGE ARE FULL SCALE (EXCEPT SKETCH OF RUDDER PEDALS & DRAWING OF C-28 (STEP)



SIDE CONSOLES (REAR)

.250 - R45 WITH 1 PLY BID @ 45° EA. SIDE

(MAKE TWO)

CENTER CONSOLE (REAR)

.250 - R45 WITH 1 PLY BID @ 45° EA. SIDE

(MAKE TWO)

TYPICAL CENTER REAR CONSOLE

(SLURRY ALL FOAM)

2 EXTRA PLIES BID LOCALLY
BUTTS TO INSTRUMENT PANEL. ADD OR REMOVE FROM THIS END TO ADJ. FIT OF PART
UP
FWD
CON-1
CON-1
CON-1
A
K1000-3
A
.8
.250
.8
CON-1
.250 PLYWOOD INSERT
(MAKE SIX)
CON-1 INSERTS HOLD CONTROL STICK ASSEM. IN PLACE
RIGHT & LEFT FRONT SIDE CONSOLE PANELS
(MAKE TWO)
CUT FROM .250 R45 - INSTALL CON-1 INSERTS (3 IN EACH PANEL) LAYUP 1 PLY BID ON EACH SIDE OF BOTH PANELS
(FULL SIZE)
BUTTS TO FWD SIDE OF SEATBACK BKHD
1.0"
2 PLY BID @ 45° ON CONSOLE TOP
FUSELAGE SIDE
MICRO
5/8" R45
MICRO
1 PLY BID @ 45°
1.2
(TYPICAL)
SIDE CONSOLE PANEL
1 BID @ 45°
BUTTS AGAINST FLOOR
CON-1
C-5
K1000-3 WITH AN426A3-8 (6 PLACES)
AN 509-10R12 (6 PLACES - 3 ON EA. SIDE PANEL)
TYPICAL
SECT A-A
1 PLY BID @ 45° EACH SIDE
1/4" R45
BUTT AGAINST SEAT BOTTOM
BUTTS AGAINST FLOOR
REAR SEAT BOTTOM CENTER SUPPORT (FULL SIZE)
5/8" R45 1 PLY BID @ 45° ON EACH SIDE (MAKE TWO)
BUTTS TO AFT SIDE FRONT SEATBACK. ADD OR REMOVE FOAM FROM THIS END TO ADJ. FIT
BUTTS AGAINST FLOOR
MATCH LINE BB PAGE D-43
FWD.
UP
B
B
90°
C
C
REAR SEAT HEAD REST 2 PLIES (FULL SIZE)
5/8" R45 ± 45°
UND
(MAKE TWO)
B
B
2 PLIES UND ± 45°
SECT C-C
2 PLIES UND ± 45°
5/8" R45
HEAD REST
1 PLY BID @ 45° TAPE
UP
FWD
MSP-43
MS20257 P3 HINGE 39"L
SECT BB
25°
1"
Ⓑ
Ⓒ

(SLURRY ALL FOAM) BEFORE GLASSING

TOP VIEW (PILOT)
SEAT BOTTOM 3/8" R-45
WITH 1 PLY BID @ 45° ON BOTTOM SIDE & 2 PLIES BID @ 45° ON TOP SIDE (MAKE ONE) NO SCALE

TOP VIEW (CO-PILOT)
SEAT BOTTOM 3/8" R45
WITH 1 PLY BID @ 45° ON BOTTOM SIDE & 2 PLIES BID @ 45° ON TOP SIDE (MAKE ONE) NO SCALE

CUT WIDTH OF BOTH SEAT BOTTOMS .4" WIDER THEN SHOWN & TRIM TO CUSTOM FIT YOUR AIRCRAFT ~

SECT C-C

SECT D-D
TYPICAL FRONT EDGE LIP ON EACH SEAT

LEFT FRONT (PILOT) SEAT BOTTOM SUPPORT
3/8" R45 w/ 1 PLY BID @ 45° ON EACH SIDE (FULL SIZE) (MAKE TWO)

"CROSS SECTION IS SAME AS B-B ON CO-PILOT"

RIGHT FRONT (CO-PILOT) SEAT BOTTOM SUPPORT
3/8" R45 WITH 1 PLY BID @ 45° ON EACH SIDE (MAKE TWO) (FULL SIZE)

SEAT SUPPORTS INSTALLATION
NOTE: TWO SUPPORTS UNDER FRONT SEATS & ONE SUPPORT UNDER REAR SEATS

SECT B-B

FRONT CENTER CONSOLE
1/4" R45 FOAM (SEE SECT A-A FOR GLASSING DETAIL) (MAKE TWO OPPOSITES) FULL SCALE

DO LAYUP ① ON OUTSIDE (OPPOSITE SIDES) OF EACH PANEL & LET CURE. REMOVE FOAM DOWN TO LAYUP ① ON EACH PANEL. ROUND EDGES AS SHOWN IN SECTION A-A. APPLY LAYUP ② WITH ADD'L. PLY BID ②A WITHIN RECESS

SEE PHOTO # 407

SHAPE OF BARE GLASS AFTER FOAM IS REMOVED

TOP VIEW

BUTTS TO CENTER LEG OF INSTRUMENT PANEL.

TYPICAL SEAT BOTTOM INSTALLATION WITH CONSOLE SIDE

TOP IS REMOVABLE ON FRONT CENTER CONSOLE. HOLD IN PLACE WITH SMALL DABS OF RTV SILICONE

COVER SIDES WITH GRAY TAPE TO KEEP 2 PLY BID LAYUP FROM STICKING TO SIDES (REMOVE AFTER LAYUP

FRONT CENTER CONSOLE PANELS

1 1/4 DIA FOR FUEL LINE TO FRONT ENGINE (BOTH PANELS)

▲▲ RELIEF OPENING IN LEFT PANEL TO CLEAR FUEL LINES

PILOT SEAT

LAYUP 3 PLIES BID AROUND STEP LAPPING ON TO FLOOR & SIDES 1.5"

ENTRY STEP C-29
1.349 X .571 4130 STREAMLINE TUBE (SEE D-42)

SECT A-A

PLY THICKNESS IS EXAGGERATED FOR CLEARITY

REAR SEAT LOWER BACK SUPPORT
5/8" R45 WITH 1 PLY BID @ 45° ON EA. SIDE (MAKE TWO)

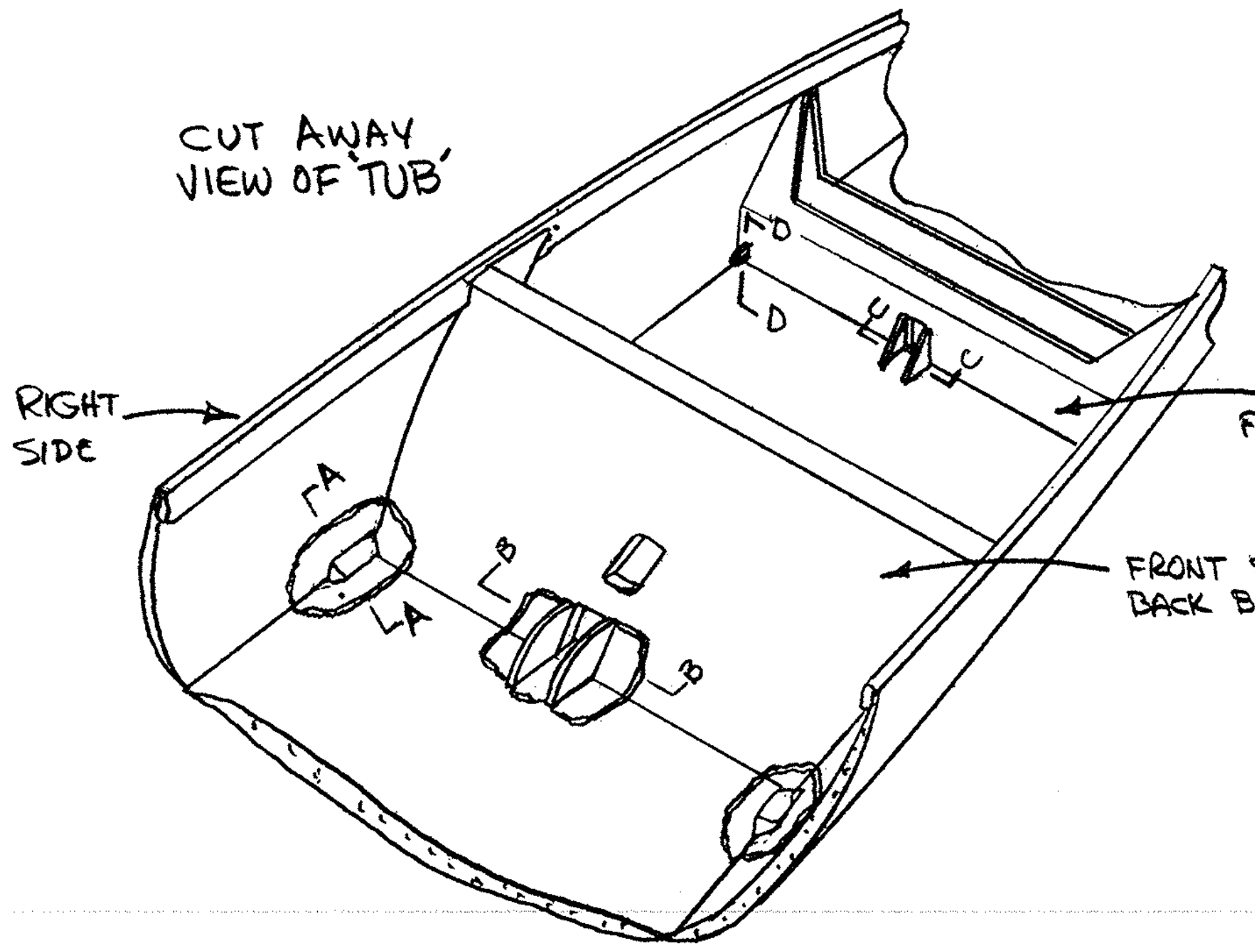
TOP VIEW
NO SCALE

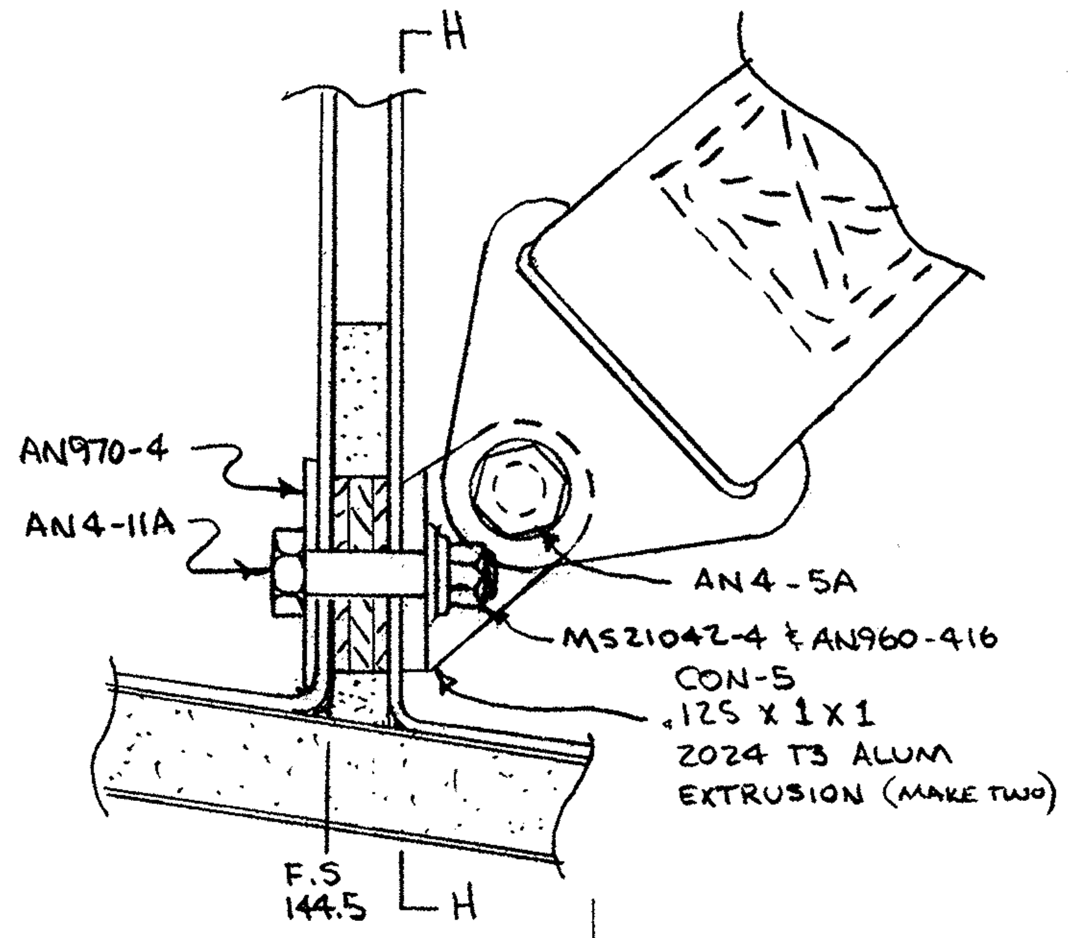
REAR SEAT BOTTOM 5/8" R45
WITH 1 PLY BID @ 45° ON BOTTOM SIDE & 2 PLIES BID ON TOP SIDE. (MAKE TWO) LEFT & RIGHT

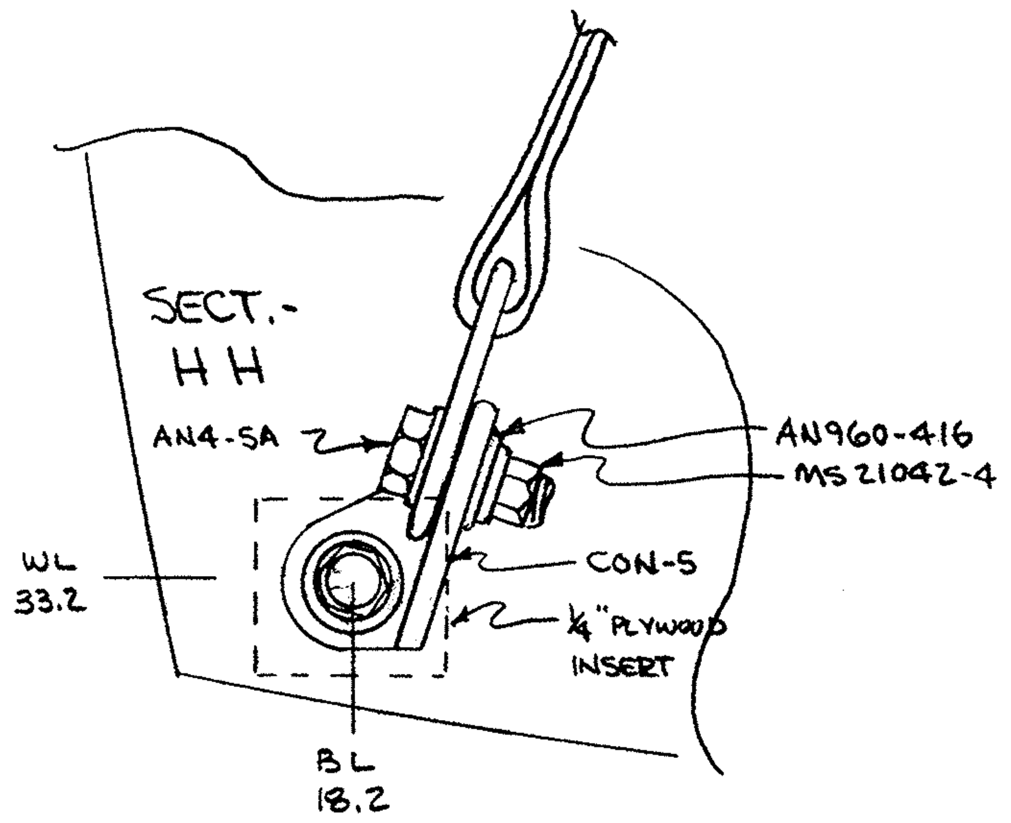
" CUT WIDTH OF BOTH BOTTOM .4" OVERSIZE - THEN TRIM EDGES FOR A CUSTOM FIT TO YOUR AIRCRAFT "

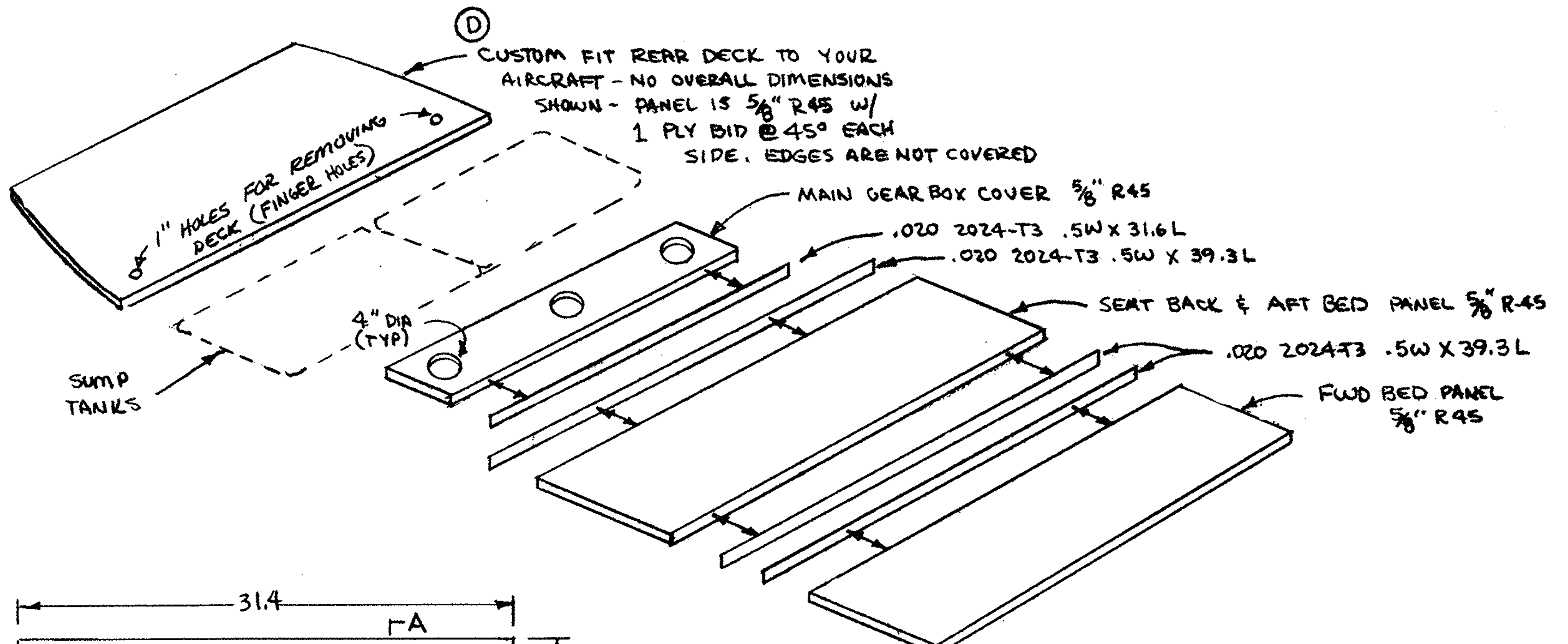
CON-2
.250 PLYWOOD (MAKE TWO) FULL SCALE

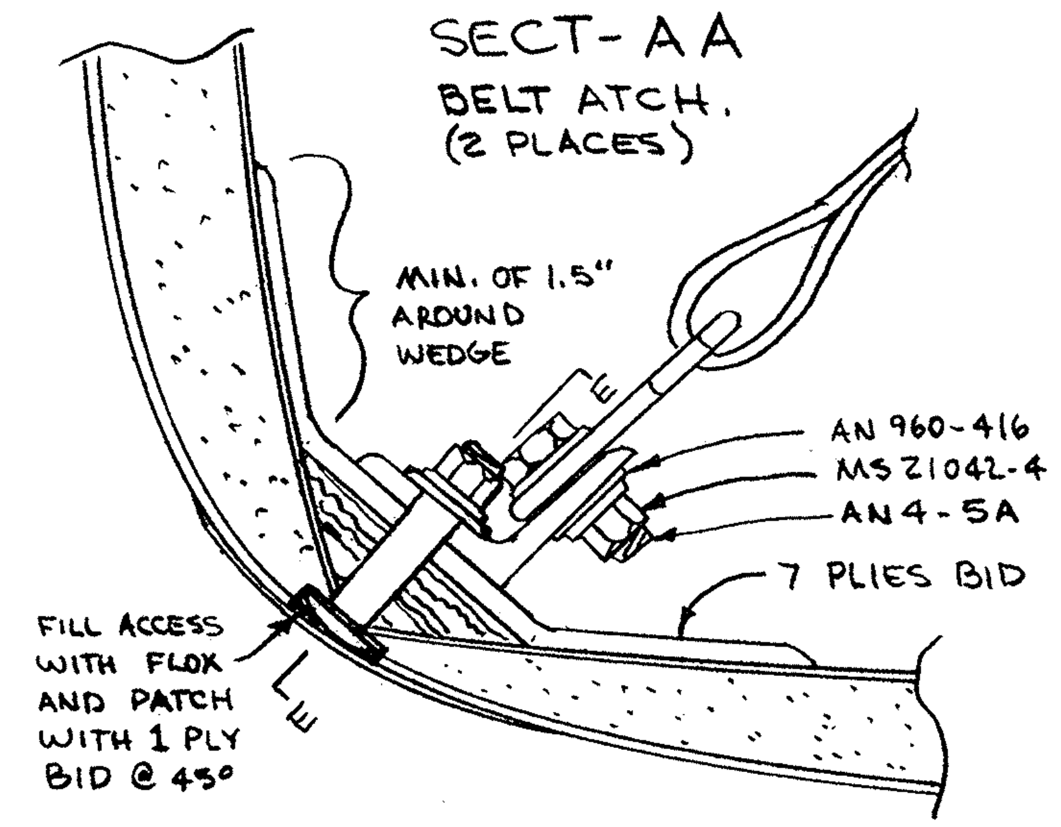
(SLURRY ALL FOAMS BEFORE GLASSING - TYPICAL)

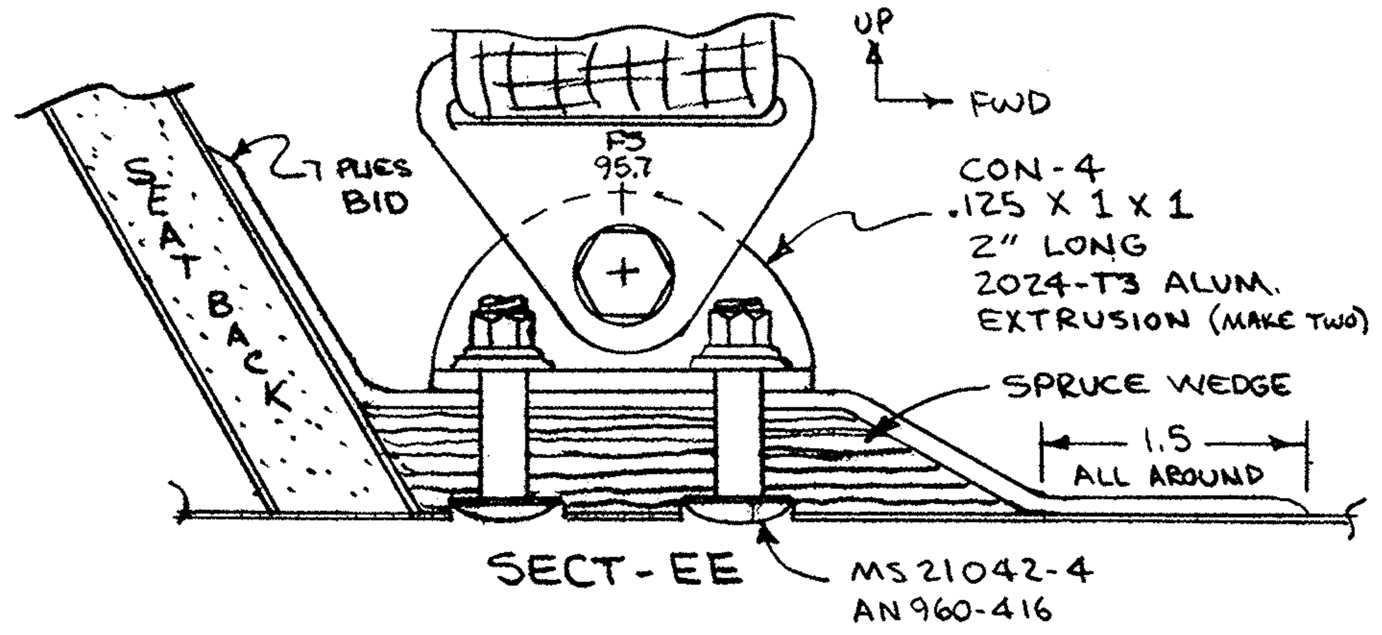


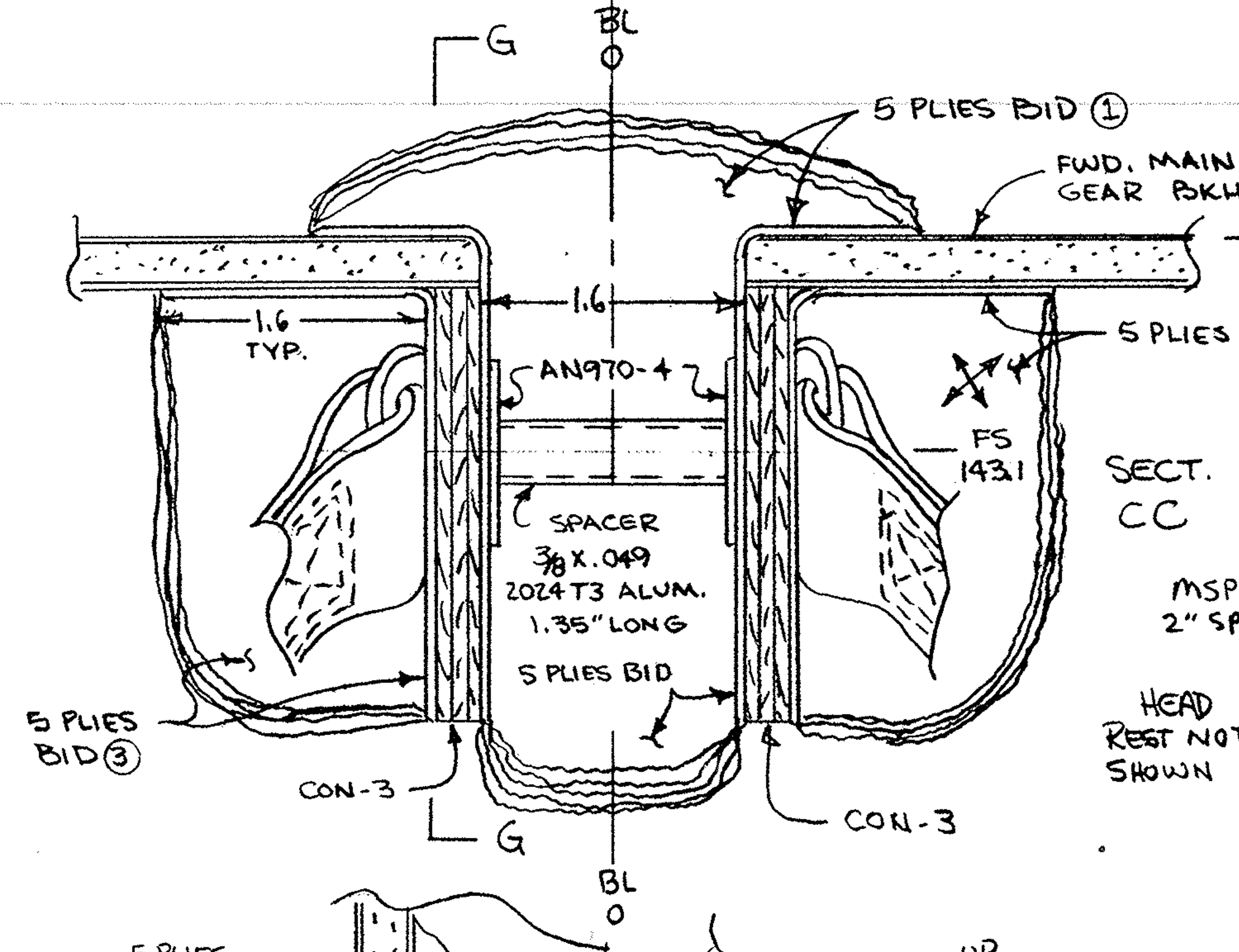


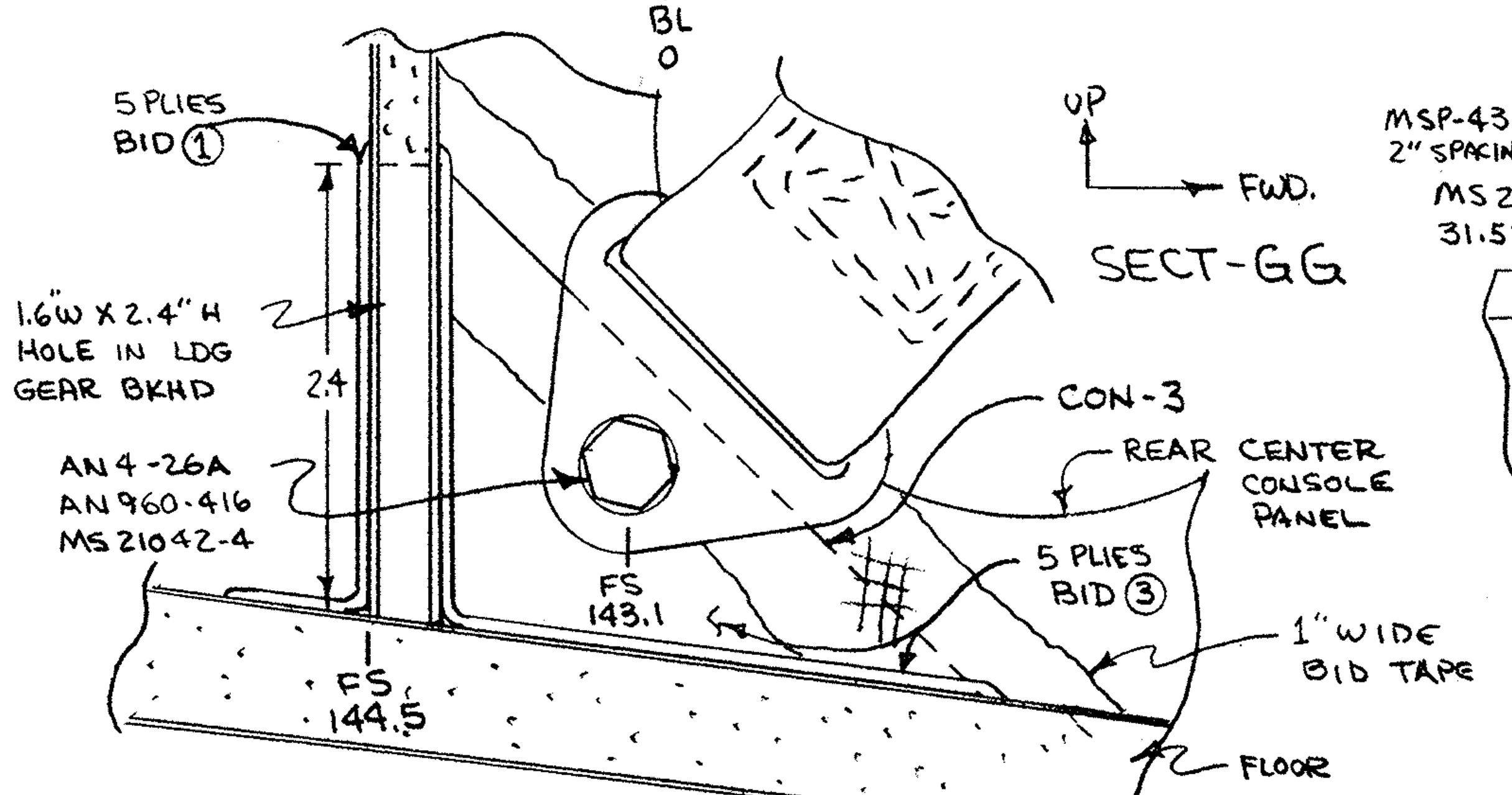


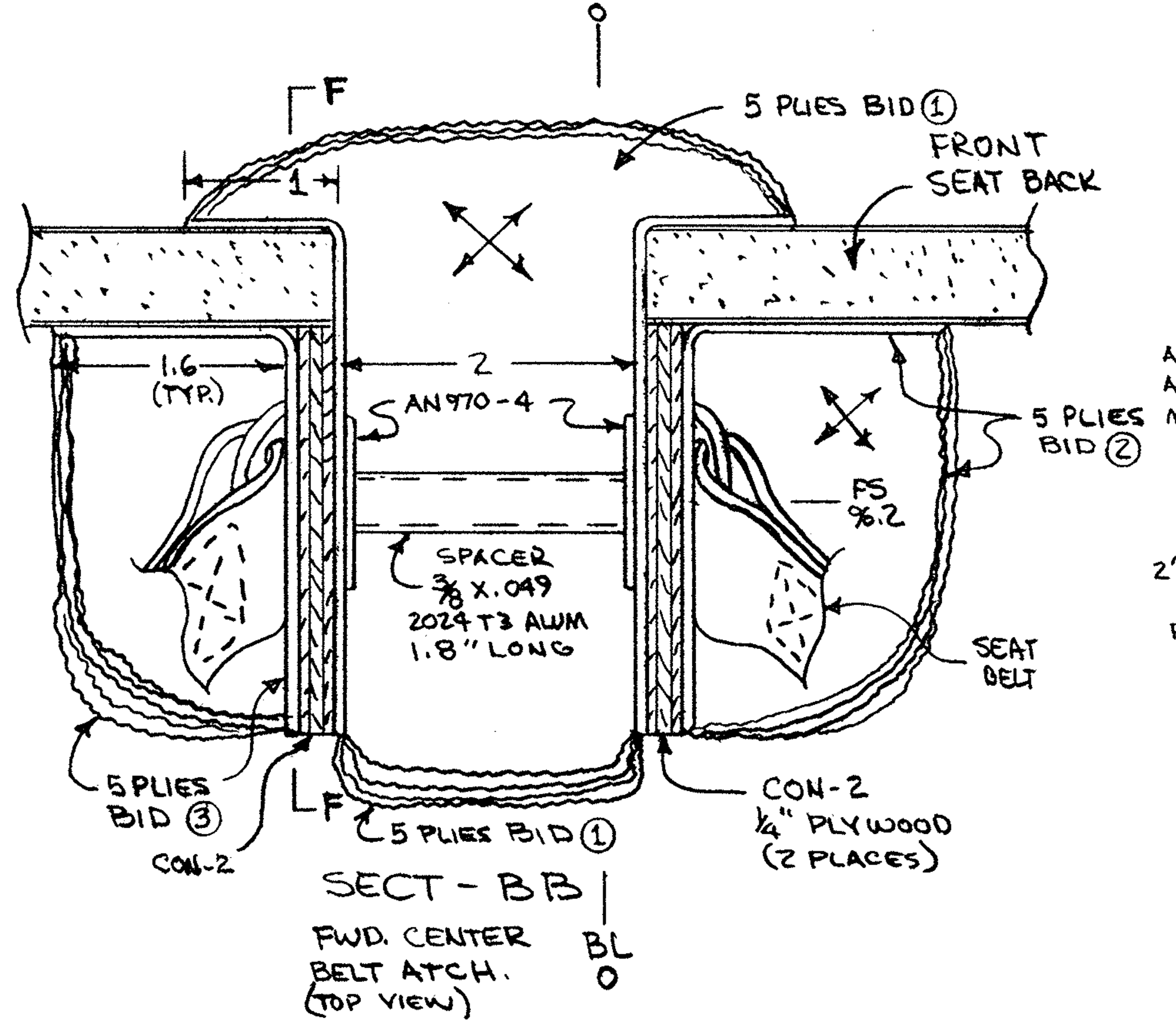

D
CUSTOM FIT REAR DECK TO YOUR AIRCRAFT - NO OVERALL DIMENSIONS SHOWN - PANEL IS ⅝" R45 w/ 1 PLY BID @ 45° EACH SIDE. EDGES ARE NOT COVERED
1" HOLES FOR REMOVING DECK (FINGER HOLES)
MAIN GEAR BOX COVER ⅝" R45
.020 2024-T3 .5W x 31.6L
.020 2024-T3 .5W x 39.3L
SEAT BACK & AFT BED PANEL ⅝" R45
.020 2024-T3 .5W x 39.3L
FWD BED PANEL ⅝" R45
4" DIA (TYP)
SUMP TANKS

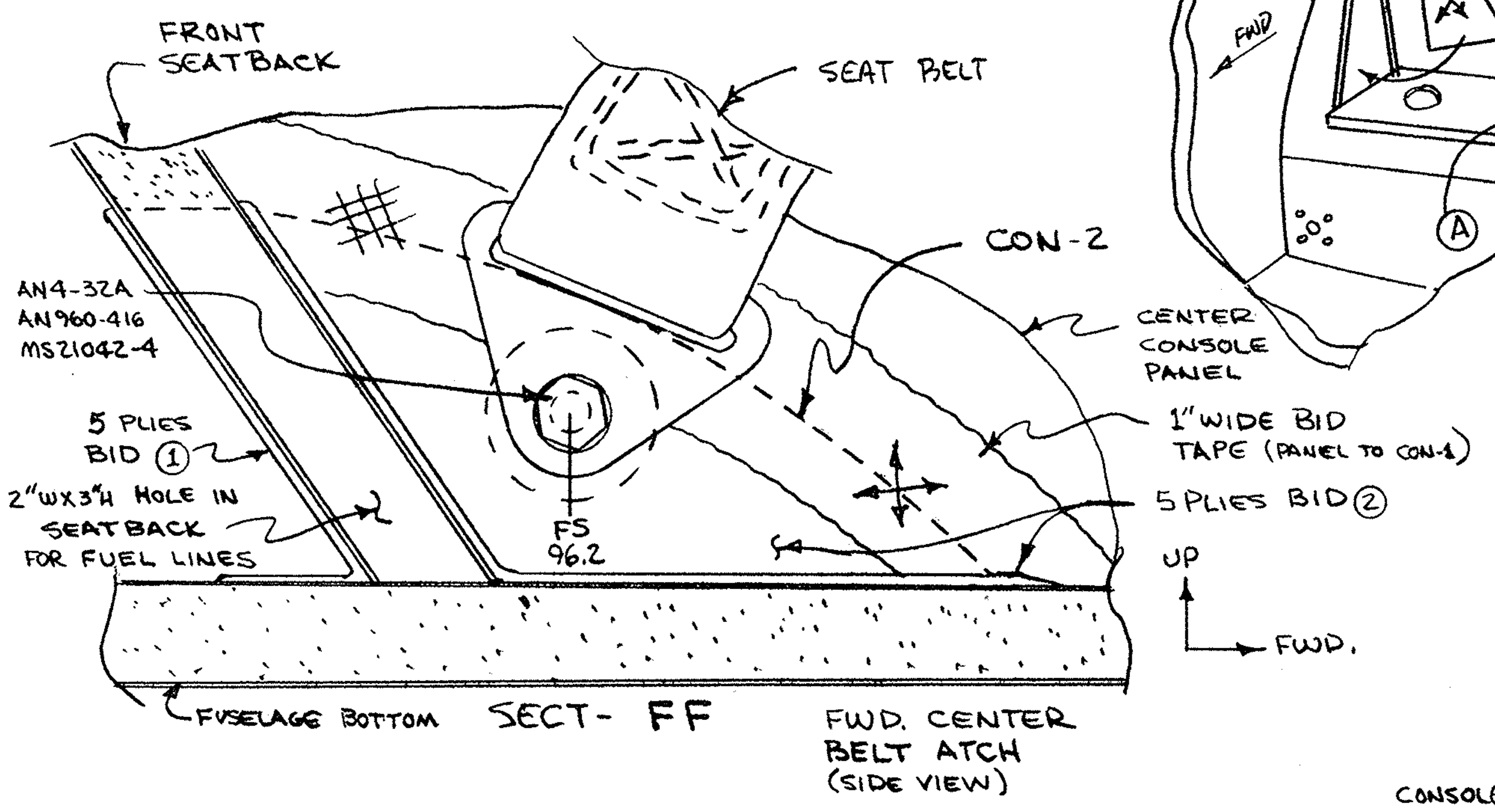

SECT- AA
BELT ATCH.
(2 PLACES)
MIN. OF 1.5" AROUND WEDGE
E
AN 960-416
MS21042-4
AN4-5A
7 PLIES BID
FILL ACCESS WITH FLOX AND PATCH WITH 1 PLY BID @ 45°
E

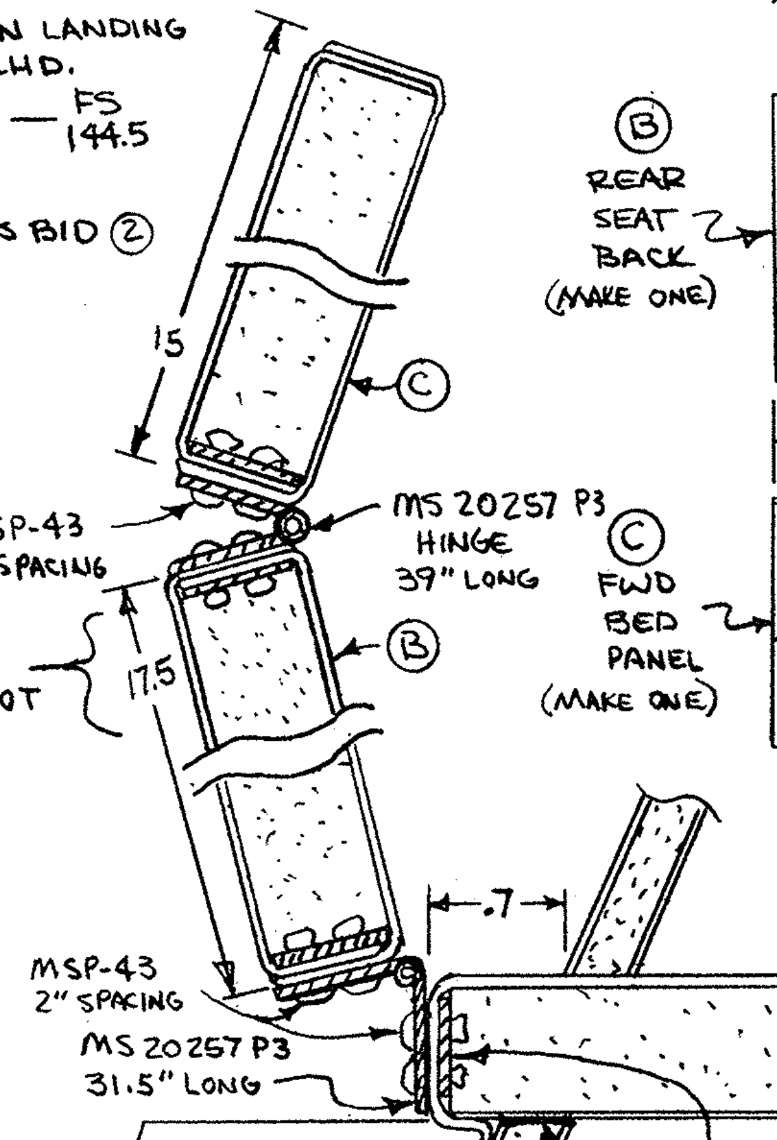


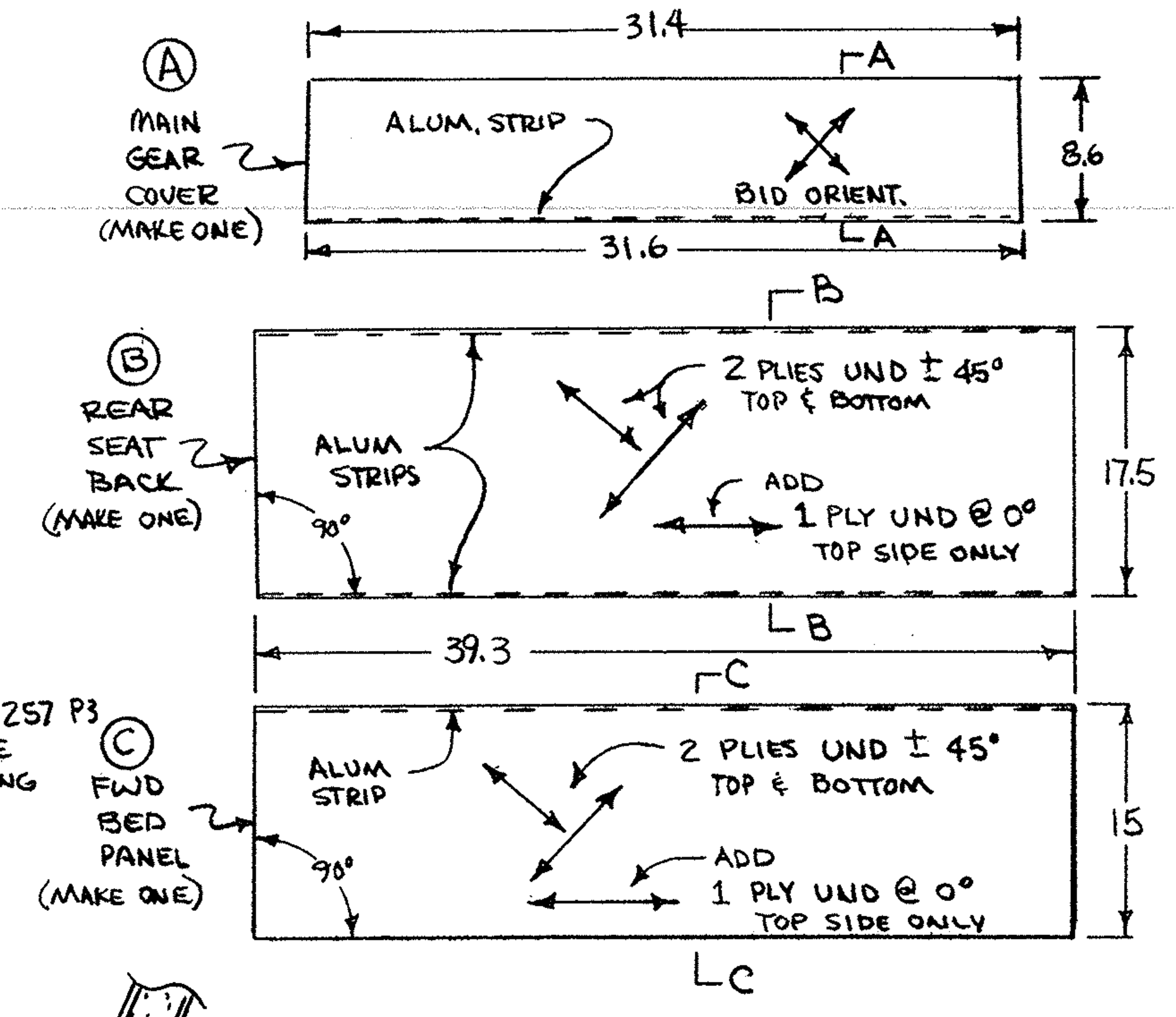


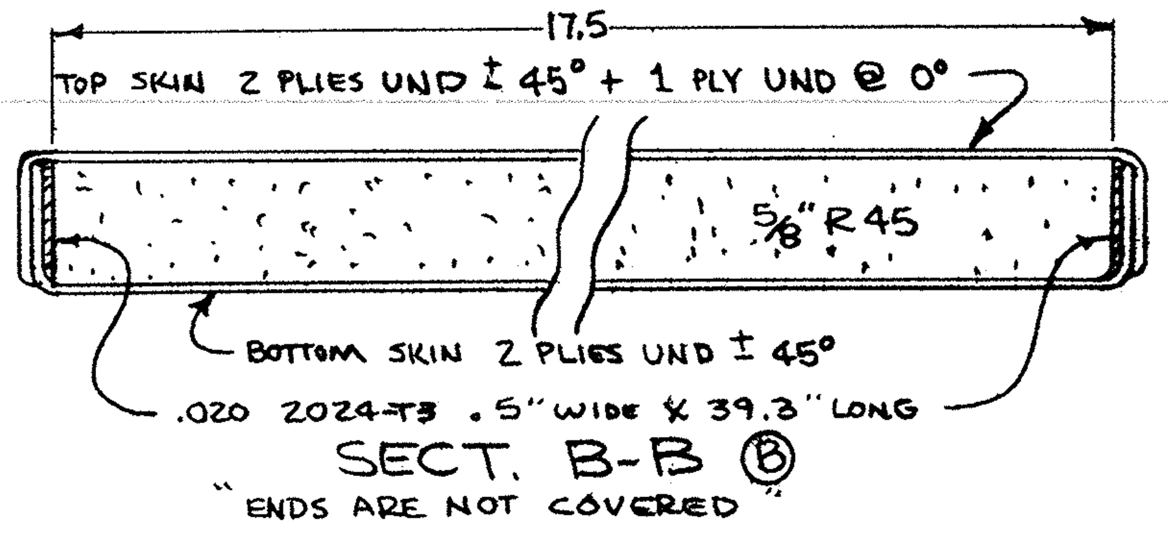


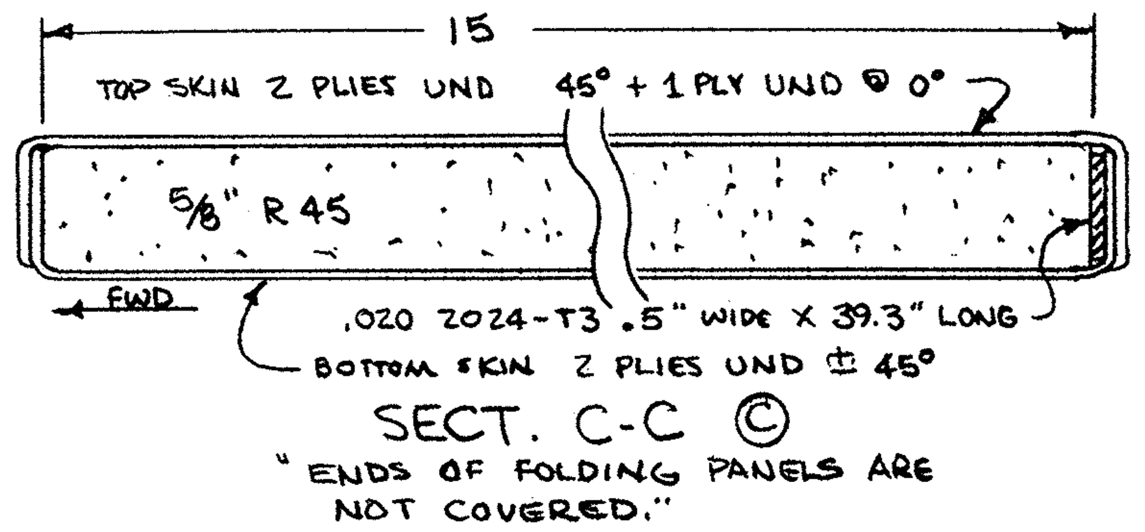


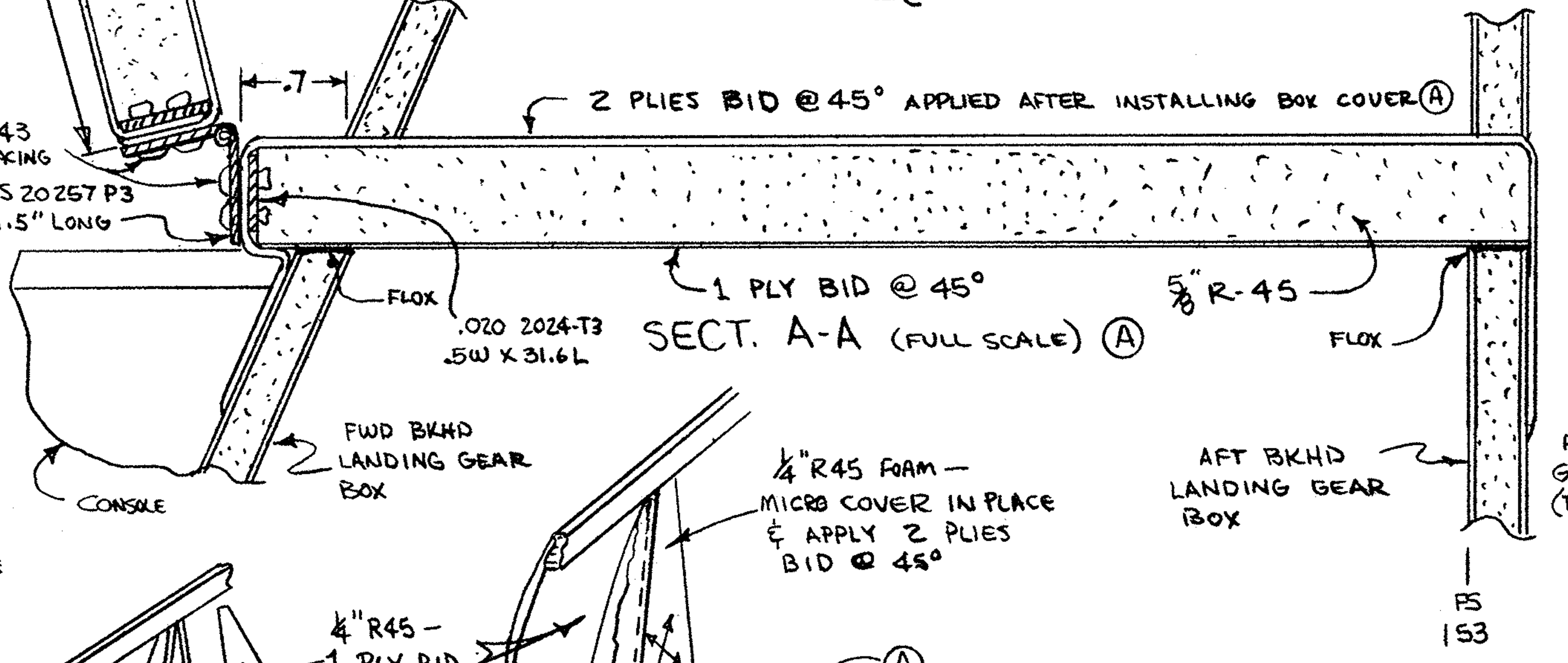


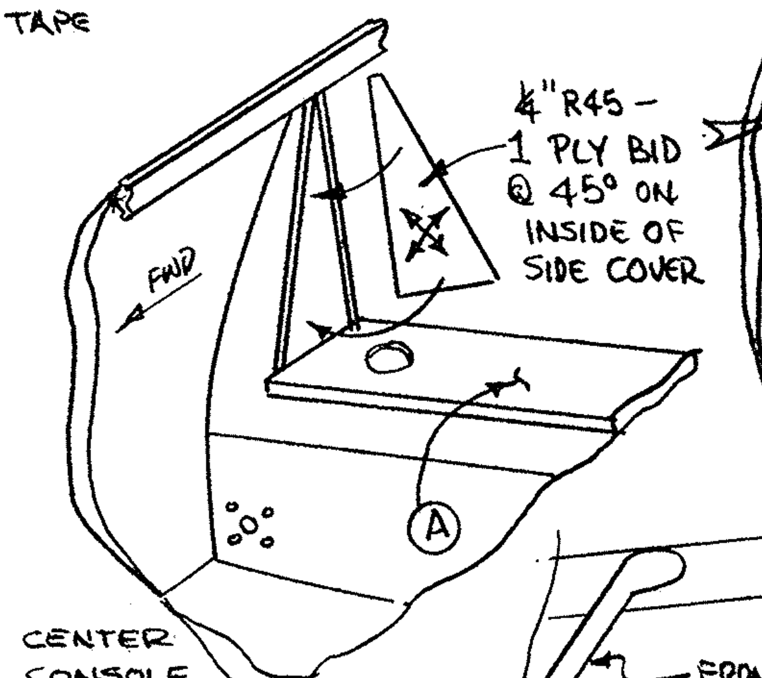


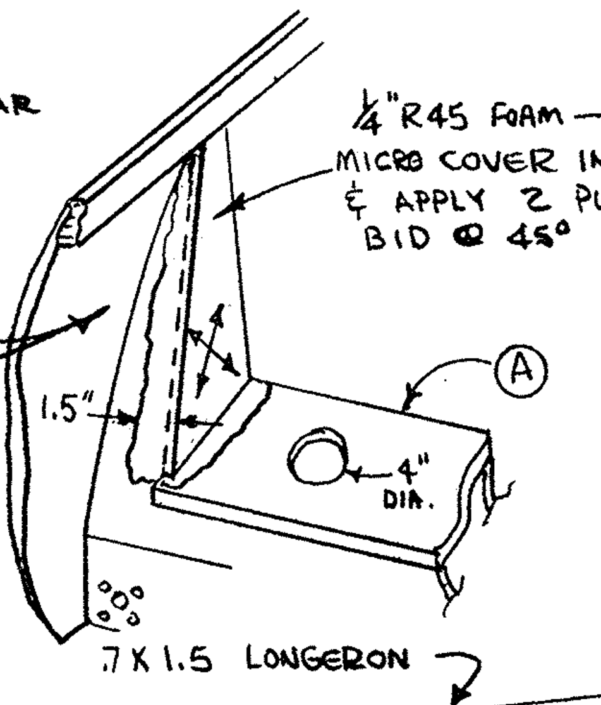

A
MAIN GEAR COVER (MAKE ONE)
31.4
A
ALUM. STRIP
BID ORIENT.
8.6
31.6
A
B
REAR SEAT BACK (MAKE ONE)
ALUM STRIPS
90°
2 PLIES UND ± 45° TOP & BOTTOM
ADD 1 PLY UND @ 0° TOP SIDE ONLY
17.5
B
39.3
C
C
FWD BED PANEL (MAKE ONE)
ALUM STRIP
90°
2 PLIES UND ± 45° TOP & BOTTOM
ADD 1 PLY UND @ 0° TOP SIDE ONLY
15
C

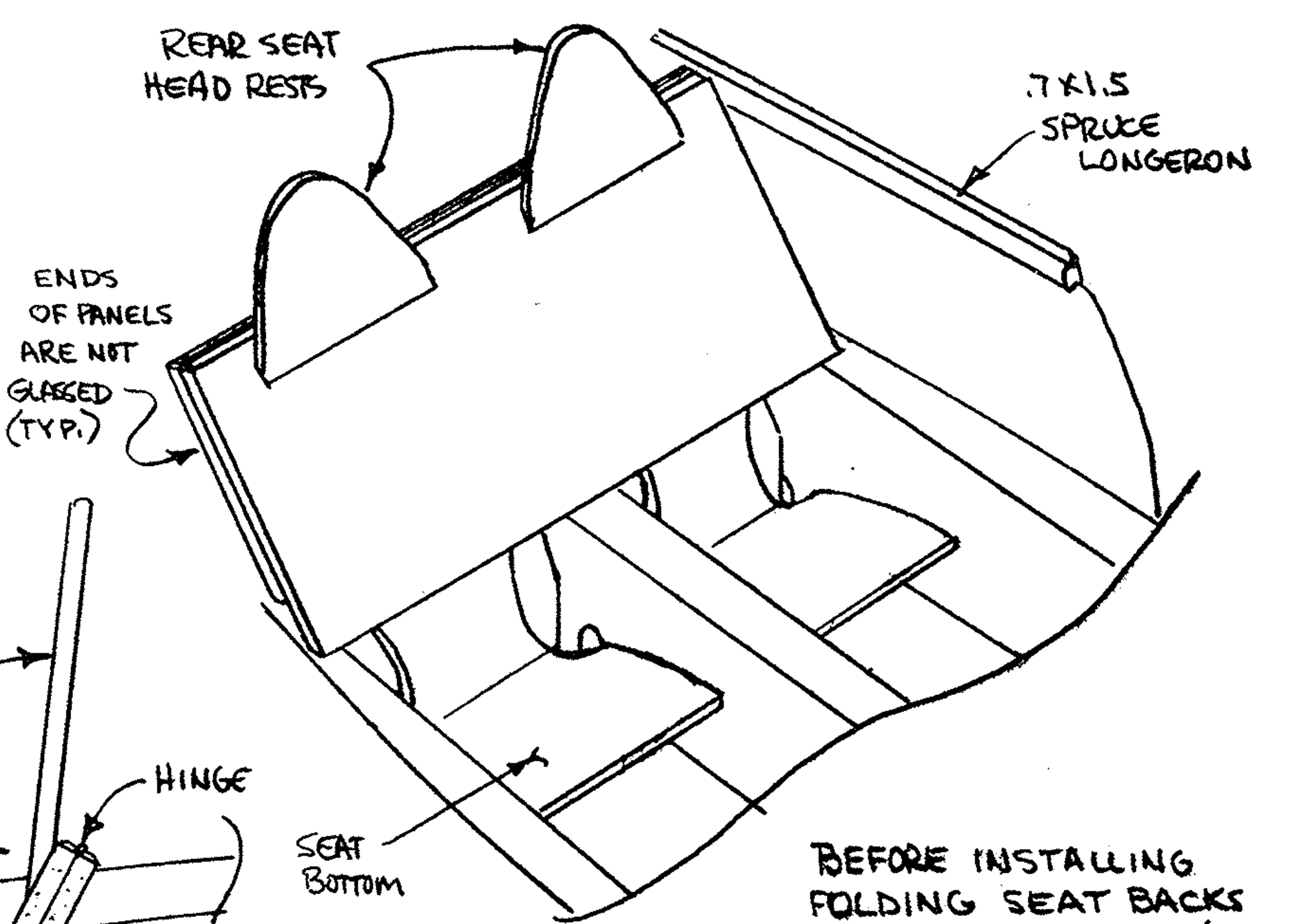

17.5
TOP SKIN 2 PLIES UND ± 45° + 1 PLY UND @ 0°
⅝" R45
BOTTOM SKIN 2 PLIES UND ± 45°
.020 2024-T3 .5" WIDE x 39.3" LONG
SECT. B-B B
"ENDS ARE NOT COVERED"


15
TOP SKIN 2 PLIES UND 45° + 1 PLY UND @ 0°
⅝" R 45
FWD
.020 2024-T3 .5" WIDE x 39.3" LONG
BOTTOM SKIN 2 PLIES UND ± 45°
SECT. C-C C
"ENDS OF FOLDING PANELS ARE NOT COVERED."

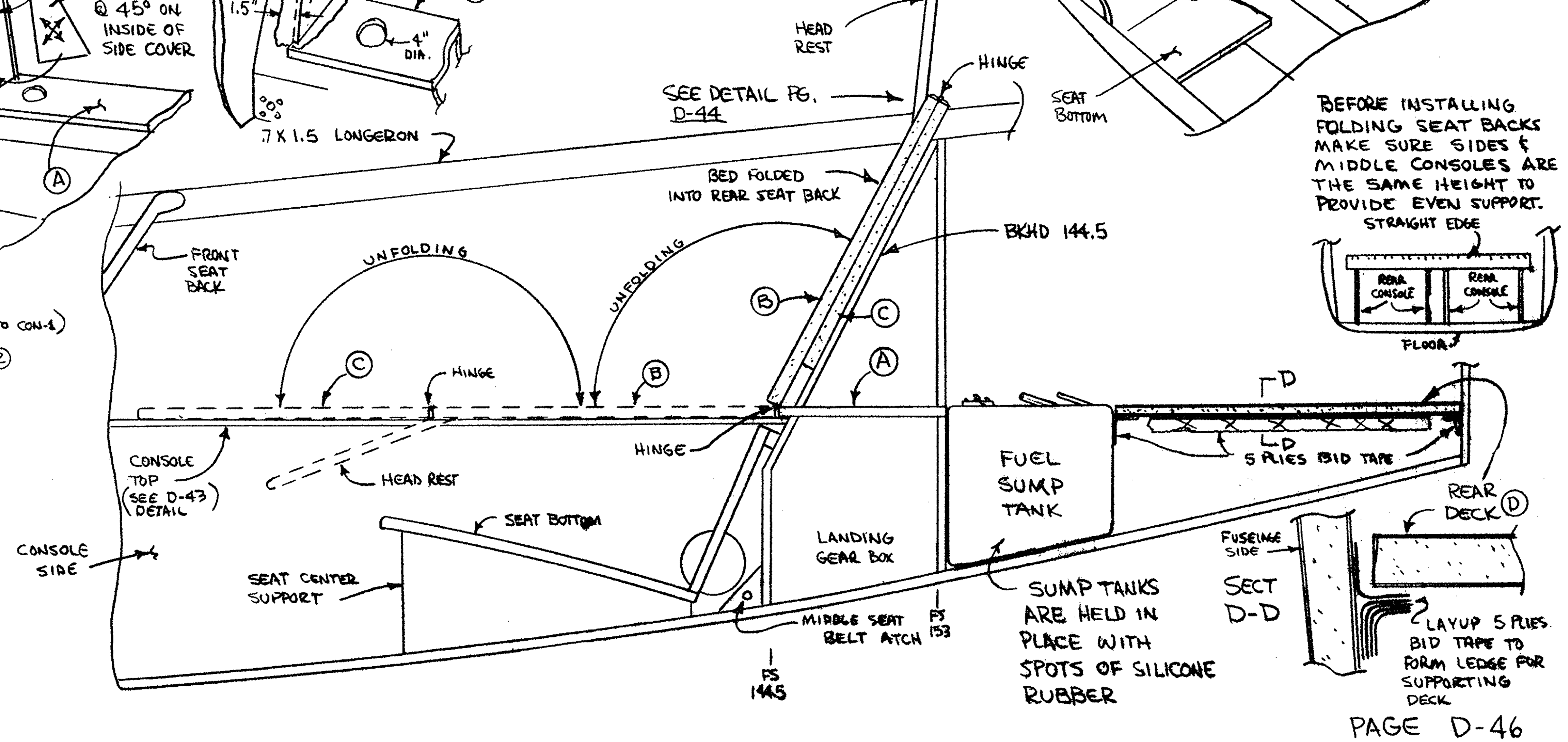

.7
2 PLIES BID @ 45° APPLIED AFTER INSTALLING BOX COVER A
FLOX
.020 2024-T3 .5W x 31.6L
1 PLY BID @ 45°
⅝" R-45
SECT. A-A (FULL SCALE) A
FLOX
CONSOLE
FWD BKHD LANDING GEAR BOX
AFT BKHD LANDING GEAR BOX
FS 153




¼" R45 FOAM - MICRO COVER IN PLACE & APPLY 2 PLIES BID @ 45°
1.5"
A
4" DIA.
.7 x 1.5 LONGERON



BEFORE INSTALLING FOLDING SEAT BACKS MAKE SURE SIDES & MIDDLE CONSOLES ARE THE SAME HEIGHT TO PROVIDE EVEN SUPPORT.



(SLURRY ALL FOAM)

||| THINK!! RIGHT REAR - LEFT FRONT |||

COUNTER SINK HOLES FOR WOOD SCREWS (TYP)
.250 (TYP)
Ⓖ TQ-7
REAR ENGINE THROTTLE (RIGHT) .125 2024-T3 (MAKE ONE) ALUM.
#12 (TYP)
1.1" R
Ⓕ TQ-6
FRONT ENGINE THROTTLE (LEFT) .125 2024-T3 (MAKE ONE) ALUM.
# 12 (TYP)
Ⓘ TQ-9
REAR ENGINE CARB. HEAT (RIGHT) .125 2024-T3 (MAKE ONE) ALUM.
Ⓗ TQ-8
FRONT ENGINE CARB. HEAT (LEFT) .125 2024-T3 (MAKE ONE) ALUM.
Ⓓ TQ-4
REAR ENGINE MIXTURE (RIGHT) .125 2024-T3 (MAKE ONE) ALUM.
Ⓑ TQ-2
FRONT ENGINE MIXTURE (LEFT) .125 2024-T3 (MAKE ONE) ALUM.
NYLON DISC.
MAKE TWO .125 WIDE DISC & MAKE TWO .250 WIDE DISC
2.25 DIA.
.250 DIA.
Ⓐ & Ⓔ
.125
MAKE TWO
Ⓐ TQ-1
.250
Ⓔ TQ-5
MAKE TWO
1.12R
#12
.250 DIA
Ⓒ TQ-3
.250
NYLON FRICTION PART (MAKE FIVE)
POINTS TOWARD FRONT ENG.
PITCH TRIM SWITCH
MIKE BUTTON
POINTS TOWARD REAR ENG.
THROTTLE FOR FRONT ENG.
SMALL WOOD SCREW - EPOXY HANDLES & SCREWS IN PLACE TO LEVERS
C
C
PITCH TRIM SWITCH DPDT MICRO 8A2041
WOOD (WALNUT) HANDLE (TYP)
THROTTLE FOR REAR ENG.
MIXTURE
FRONT ENG.
REAR ENG.
CARB. HEAT
REAR ENG.
FRONT ENG.
A
A
B
B
MIXTURE (SQUARE)
SECT A-A
CARB. HEAT (ROUND)
SECT B-B
SILICONE COVER IN PLACE- .125 2024-T3
THROTTLE FRICTION ADJ. KNOB (WOOD KNOB WITH BLIND NUT FLOX IN PLACE)
AN4-33A
AN3-31A
Ⓐ Ⓑ Ⓒ Ⓒ Ⓔ Ⓕ Ⓒ Ⓔ Ⓒ Ⓗ Ⓒ Ⓐ
AN525-10R12 & MS21042-3
LEFT SIDE PANEL OF FWD. CENTER CONSOLE
Ⓓ Ⓖ Ⓘ
HM-3
RIGHT CONSOLE SIDE
NO ADDITIONAL DETAILS ARE GIVEN FOR THIS METHOD OF TRIM & MIKE BUTTON INSTALLATION NOTE: BUTTON & SWITCH (TRIM) CAN BE MOUNTED ELSEWHERE CONVENIENT TO PILOT
TQ-6 FRONT ENGINE THROTTLE LEVER
3/16" O.D. ALUM. MODEL AIRPLANE TUBING FLATTEN TO .125 WIDTH O.D. WITH ONE EDGE CUT AWAY TO FORM CHANNEL - EPOXY IN PLACE OVER WIRING. CHECK FOR PROPER WIRING OPERATION BEFORE INSTALLING LEVER IN QUADRANT. AFTER CURE POLISH COVER (CHANNEL) WITH STEEL WOOL TO BRING OUT LUSTER.
GROUND
WIRING TO TRIM (PITCH) MOTOR & RADIO (MIKE BUTTON)
FRONT ENGINE CARB. HEAT IN COLD POSITION
REAR ENGINE THROTTLE IN IDLE POSITION
SILICONE IN PLACE
TQ-8
TQ-7
.125 2024-T3 ALUM. COVER (SILICONE IN PLACE)
1/4" R45
2 PLIES BID @ 45° (TYPICAL ON ALL CONSOLE TOPS)
1 PLY BID @ 45° (TYP. ON ALL CONSOLE LID UNDERSIDE)
SILICONE COVER IN PLACE - SPOT EVERY 3" TO HOLD FIRM BUT ALLOW REENTRY
WIRING TO WARN'G SYSTEM
MICRO SWITCH RADIO SHACK 275-1102 OR MICRO TYPE V3 - MOUNTED ON WOOD WEDGE OR METAL FIXTURE TO ALLOW CONTACT WITH REAR ENGINE THROTTLE HANDLE
GERDES A-900-3 55" LONG, 10-32 THREADS EACH END (3 REQ.)
FWD
TQ-3
AN 393-11
AN 960-10 (5 PLACES)
AN 665-21R (5 PLACES)
PUSH-PULL CABLE ANCHOR
ANCHOR NUT
A-900 PUSH-PULL 120" LONG, 10-32 THREADS EACH END (3REQ.)
LEFT CONSOLE SIDE (CENTER FRONT)
CONSOLE SIDES
AFTER ANCHOR LOCATION HAS BEEN DETERMINED FOR YOUR CABLES INSTALL PLYWOOD HARD POINT IN SIDES OF CONSOLE AND PATCH WITH BID
ANCHOR NUT
NO DIMESIONS ARE GIVEN FOR CABLE ANCHOR SINCE CONSOLE WIDTHS & PUSH-PULL CABLES AND LOCATIONS MAY DIFFER.
ANCHOR NUTS

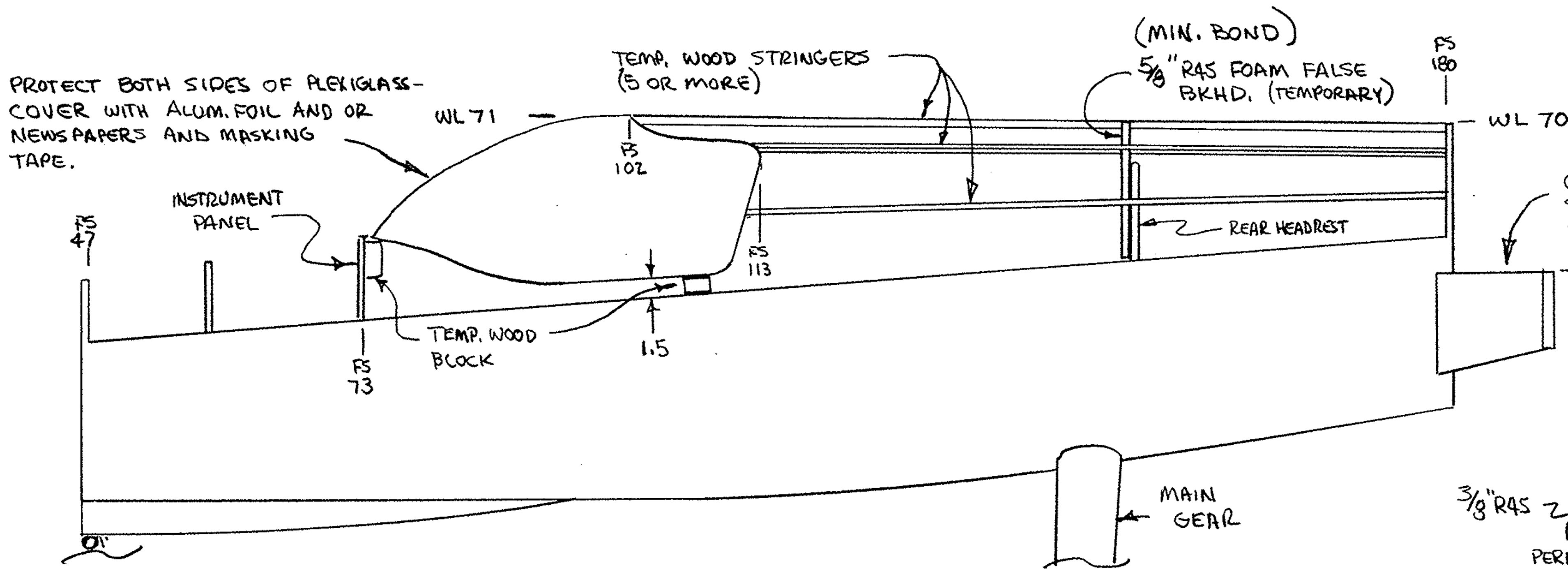
SECT C-C TOP VIEW OF THROTTLE HANDLES

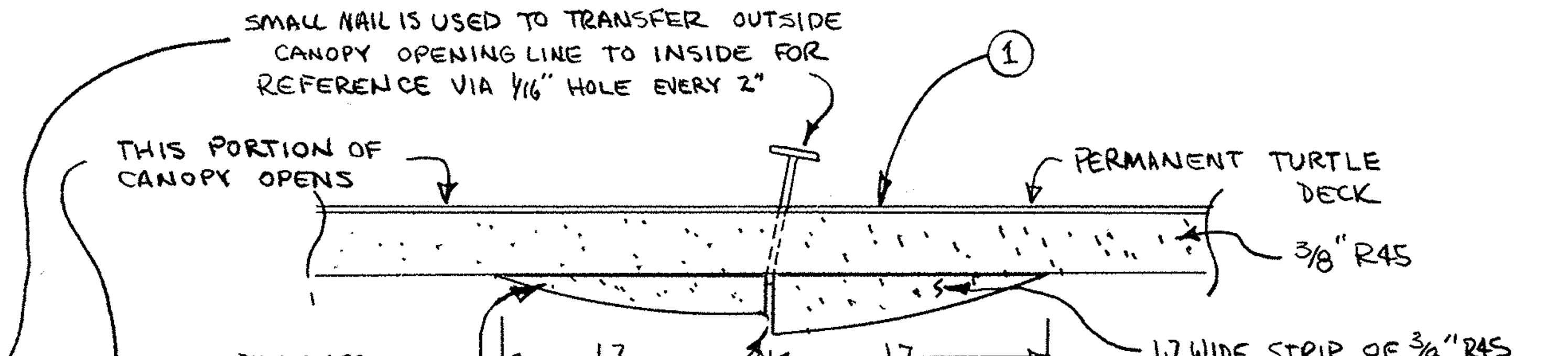
REAR VIEW CENTER CONSOLE CONTROL QUADRANT (FULL SCALE)

PUSH - PULL CABLE ANCHOR

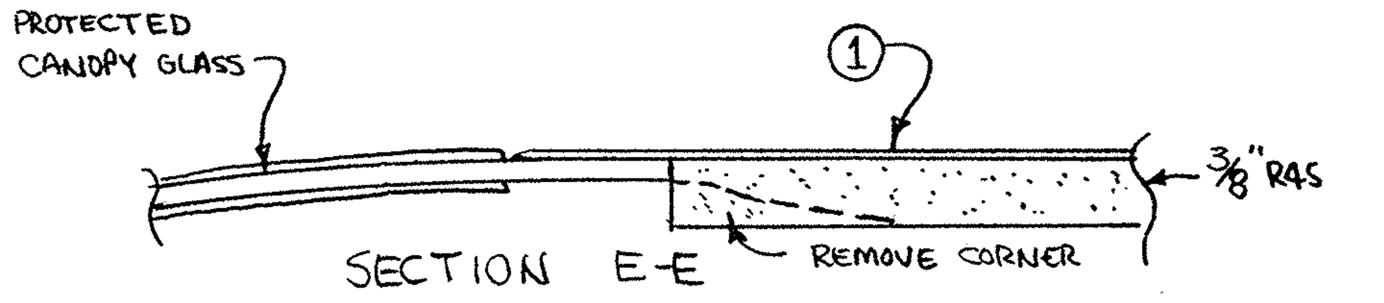
.125 2024-T3 EXTRUDED ALUM. (MAKE TWO PAIRS)
C-10
ONE PAIR
.250 DIA.
.250 DIA
END VIEW
SIDE VIEW
END VIEW
FULL SIZE
FULL SIZE
SIDE
C-11
.125 2024T3 ALUM ANGLE (MAKE ONE)
.65
.250 DIA
TOP
.75
END
C-12
.125 2024-T3 ALUM ANGLE EXTRUDED (MAKE ONE)
.75
SIDE
.65
END
TOP
.25 DIA.
FULL SIZE
USE AN470AD3-8 (8 PLACES) TO RIVET C-8, C-9, & C-10 TOGETHER
BEND
FWD
.750 DIA.
.750 DIA.
C-8
.125 2024-T3 ALUM. (MAKE TWO) SEE NOTE ABOVE (FULL SIZE)
BC4-W10 BELLCRANK BEARING SANDWICH BETWEEN C-8 & C-9 USE SIX AN470AD4-8 RIVETS
FWD.
.250 DIA. (8 PLACES)
C-9
.125 2024-T3 ALUM. (MAKE TWO) FULL SIZE
C-8
C-8
BEND C-8 PARTS TO COMPENSATE FOR THICKNESS OF BELL CRANK FLANGE - NOTE C-8 PARTS ARE BENT OPPOSITE EACH OTHER (NO SCALE)
BEND
BEND
.070
.070
#12
.250 DIA
FWD
BC4-W10 BELLCRANK BEARING WITH SIX AN470AD4-6
#12
C-7
.125 2024-T3 ALUM. (MAKE TWO) FULL SIZE
#10
#10
FWD.
.250 DIA. (4 PLACES)
#10
C-5
.063 2024-T3 ALUM. (MAKE TWO) FULL SIZE
(MAKE ONE) LEFT HANDLE C-2
FWD
(MAKE ONE) RIGHT HANDLE C-1
FWD
5.6
1/2 X .049 4130 STL.
FULL SIZE
127°
REAM TO .375 ±.001 DIA. AFTER WELDING
.250 DIA.
1.6
REAR VIEW OF RIGHT HANDLE-ARM ON LEFT HANDLE IS OPPOSITE RIGHT
1/2 X .065 4130 STL.
1/2 X .065 4130 STL.
.374 ±.001
.25
1.0
OILITE BUSHING (MAKE TWO)
C-3
.1
.995
.995
.1
C-14 (SPACER)
.25
.5
1.15
2024-T3 ALUM. (MAKE FOUR) FULL SIZE
C-13 (MAKE TWO)
.8
.4
2.3
HARD WOOD STOP FOR C-11 & C-12. EPOXY IN PLACE AND COVER W/ 1 PLY BID @ 45° LAPPING .7" ON TO FUSELAGE SIDES ALL AROUND.
C-15 (SPACER)
.25
.5
.65
2024-T3 ALUM. (MAKE SIX) FULL SIZE
C-16 (SPACER)
.25
.5
.525
2024-T2 ALUM. (MAKE TWO) FULL SIZE
C-17
1.0
#12 (2 PLACES)
.6
.063 2024-T3 ALUM. (MAKE EIGHT) FULL SIZE
C-18 (SEE PAGE D-27)
.125 2024-T3 ALUM. (MAKE ONE) FULL SIZE
.250 DIA
THIS LINE REF. BOTTOM OF LONGERON (MARK ON PART WITH INK)
FWD
TAP 1/4"-28 NF THREAD
FWD.
.250 DIA. (4 PLACES)
C-6
.063 2024-T3 ALUM. (MAKE TWO) FULL SIZE
FWD
.250 DIA. (3 PLACES)
C-4
.063 2024-T3 ALUM. (MAKE TWO) FULL SIZE
WELD .063 X .2 WIDE 4130 STEEL STRIP TO INBD FWD EDGE
.2
.250 DIA.
C-27D
.063 4130 STEEL FULL SIZE (MAKE ONE)
4.7
FWD
INBD SIDE
STIFFENER
WELD
1 1/4 DIA.
#10
.250 DIA.
C-27 B
.040 4130 STL. FULL SIZE (MAKE FOUR)
5/8 R
#10
SEE PAGE D-26 FOR COMPLETED C-27
41.5
1.25
C-27 A (SEE PG. D-26)
1 1/4 X .035 X 41.5 LONG 4130 STEEL (MAKE ONE)
C-27C FULL SIZE .063 4130 STEEL (MAKE ONE)
.250 DIA.
1 1/4 DIA.
38.5
PART OF C-20
1.25
1 1/4 X .035 4130 STEEL C-20B
38.4
WELD
NO SCALE
SHOULDER OF OILITE BUSHING
C-20B 1 1/4 X .035 4130 STL
WELD
SHOULDER OF OILITE BUSHING
C-20A
C-20A
REAR VIEW
ELEVATOR ACTUATOR
C-20 (COMPLETE WELDED UNIT)
.250 DIA. (4 PLACES)
1 1/4" DIA.
.065
.125 4130 STEEL-WELD TO C-20A. POSITION ON OPPOSITE SIDES OF EACH ARM.
FWD
C-20A
.063 4130 STEEL (MAKE TWO)
FULL SIZE
PART OF C-20
.500 DIA.
.250 DIA.
C-22
.125 2024-T3 ALUM. FULL SIZE (MAKE ONE) FULL SIZE
FWD
TAP 1/4"-28 NF THREAD
.250 DIA.
1/2 X .035 X 2.45 L 4130 STL.
Ⓐ
2.45
AN316-4
AN470 AD4-10 (EPOXY)
AN490 HT 16P
HF-4
AN490 HT8P
1/2 X .035 Ⓐ
AN316-6
HF-6
C-26 FULL SIZE (MAKE TWO COMPLETE RODS)
AN316-4
AN316-4
HM-4
22.5
HM-4
C-21
1/2 X .035 X 22.5 LONG 2024-T3 ALUM. (MAKE TWO)
INS-1
AN 470 AD4-10 (4-PLACES)
9.8
.75
.15
3/32
FOR WOOD SCREW ON C-24
FOR COTTER PIN
AN 490 HT 8P
AN 470 AD4-10
C-25
1/2 X .035 X 9.7 LONG 2024 T3 ALUM. (MAKE ONE)
C-24
3 PLIES 1/4 PLYWOOD LAMINATE W/ EPOXY (MAKE ONE) FULL SIZE
A
.500 DIA
2"
WOOD SCREW
A
SECT A-A
C-23 (MAKE ONE)
.063 2024-T3 ALUM.
#10
5/8" DIA.
#10
1/8 R (TYP)
FULL SIZE
C-2
C-2
C-3
C-10
AN4-16A
AN960-416
MS21042-4
AN4-13A
C-4
AN960-416
C-17
HF-4
HM-4
C-6
C-5
C-9
C-17
C-7
C-10 (PAIR)
AN470AD3-8 (8 PLACES)
C-15
C-8 BEARING
AN4-11A
C-11
C-5
C-15
C-14
BEARING
C-16
C-6
C-14
HF-4
HM-4
C-11
AN4-7A
MS21042-4
AN970-3 (DRILLED TO .250 ID)
C-4
AN960-416
AN4-23A (3 PLACES)
MS21042-4
C-7
AN3-6A (2 PLACES)
C-17 (4 PLACES)
MS21042-3 & AN960-10 (2 PLACES)
C-9
LEFT SIDE CONSOLE
LOOKING AFT AT LEFT SIDE CONTROL STICK

ALL PARTS ARE FULL SCALE
(UNLESS NOTED - NO SCALE)

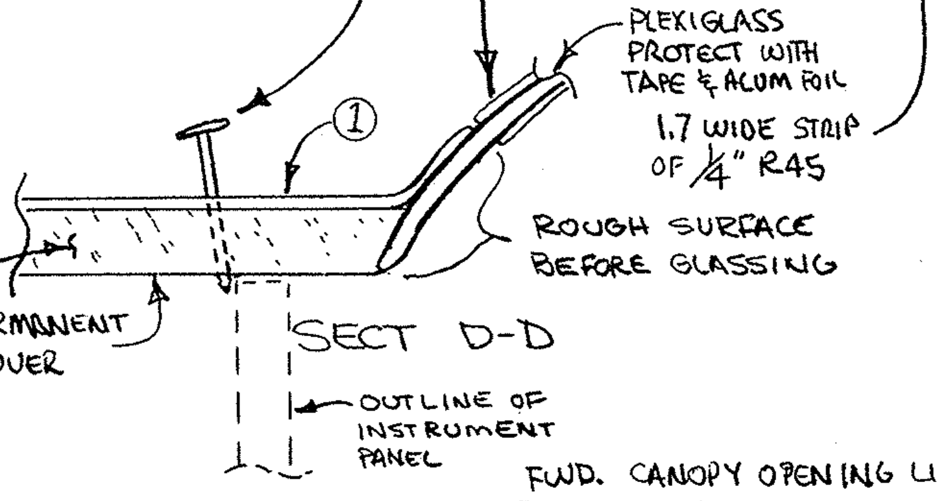

PROTECT BOTH SIDES OF PLEXIGLASS-COVER WITH ALUM. FOIL AND OR NEWSPAPERS AND MASKING TAPE.
WL 71
TEMP. WOOD STRINGERS (5 OR MORE)
(MIN. BOND)
5/8" R45 FOAM FALSE BKHD. (TEMPORARY)
FS 180
WL 70
CENTER SECTION SPAR
WL 65
FS 47
INSTRUMENT PANEL
FS 102
FS 113
REAR HEADREST
TEMP. WOOD BLOCK
1.5
FS 73
MAIN GEAR


SMALL NAIL IS USED TO TRANSFER OUTSIDE CANOPY OPENING LINE TO INSIDE FOR REFERENCE VIA 1/16" HOLE EVERY 2"
①
THIS PORTION OF CANOPY OPENS
PERMANENT TURTLE DECK
3/8" R45
1.7
1.7
1.7 WIDE STRIP OF 3/8" R45 MICRO & HOT GLUE IN PLACE
DO NOT ALLOW JOINT TO FILL WITH MICRO OR EPOXY

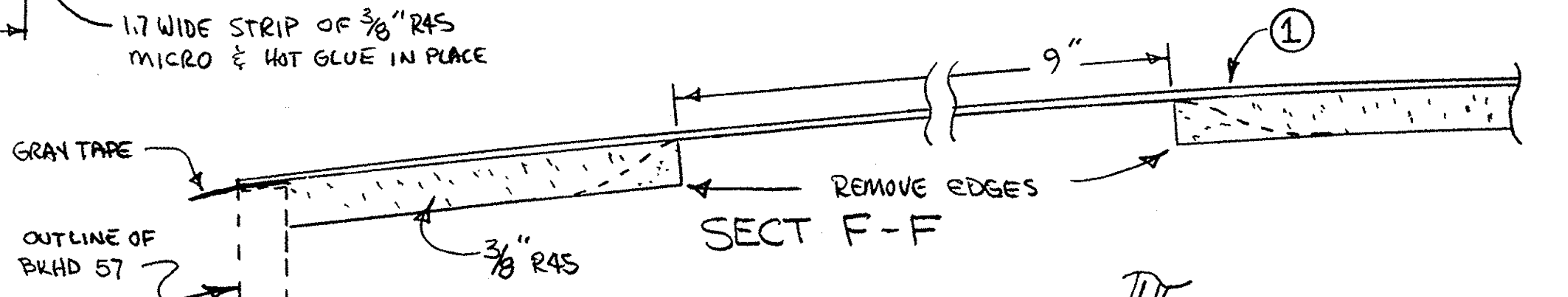
SECTION C-C



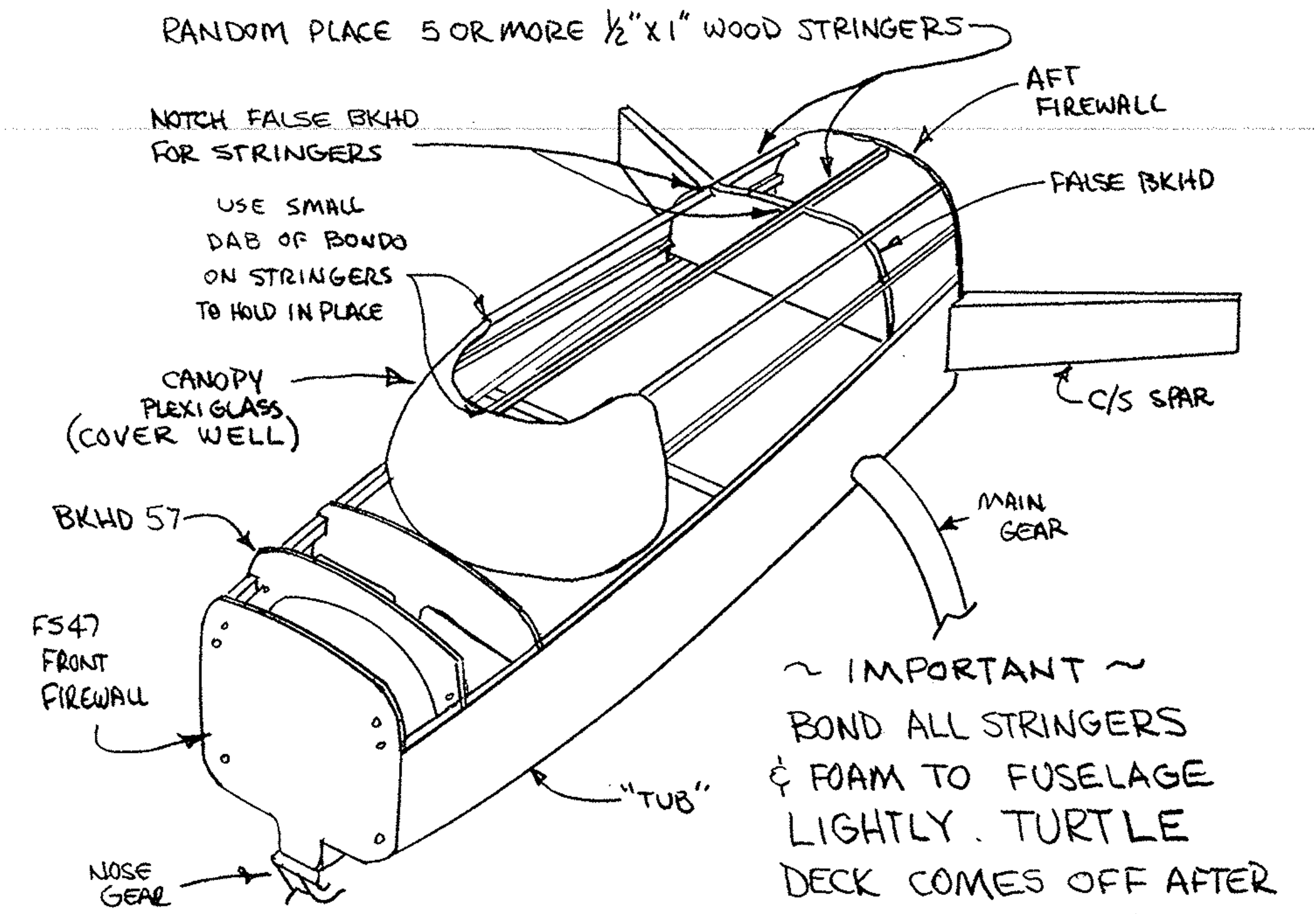
SECTION E-E


PLEXIGLASS PROTECT WITH TAPE & ALUM FOIL
①
1.7 WIDE STRIP OF 1/4" R45
3/8" R45
ROUGH SURFACE BEFORE GLASSING
PERMANENT COVER
OUTLINE OF INSTRUMENT PANEL

SECT D-D



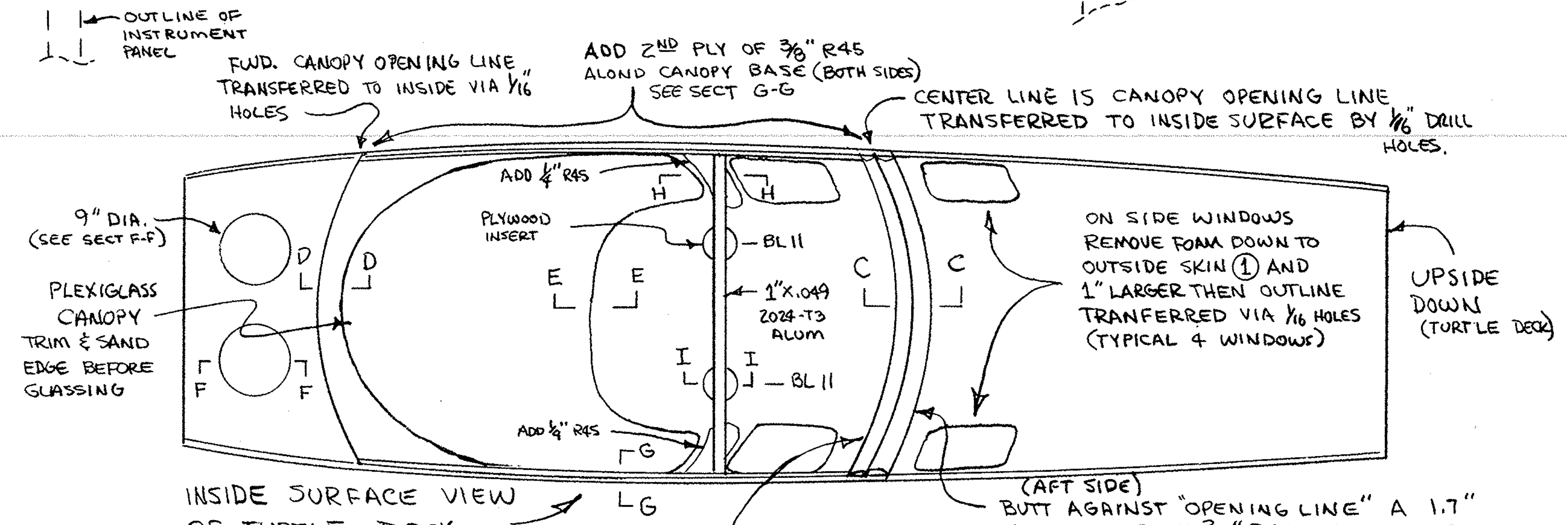
SECT F-F


RANDOM PLACE 5 OR MORE 1/2"x1" WOOD STRINGERS
AFT FIREWALL
NOTCH FALSE BKHD FOR STRINGERS
FALSE BKHD
USE SMALL DAB OF BONDO ON STRINGERS TO HOLD IN PLACE
C/S SPAR
CANOPY PLEXIGLASS (COVER WELL)
MAIN GEAR
BKHD 57
FS47 FRONT FIREWALL
"TUB"
NOSE GEAR

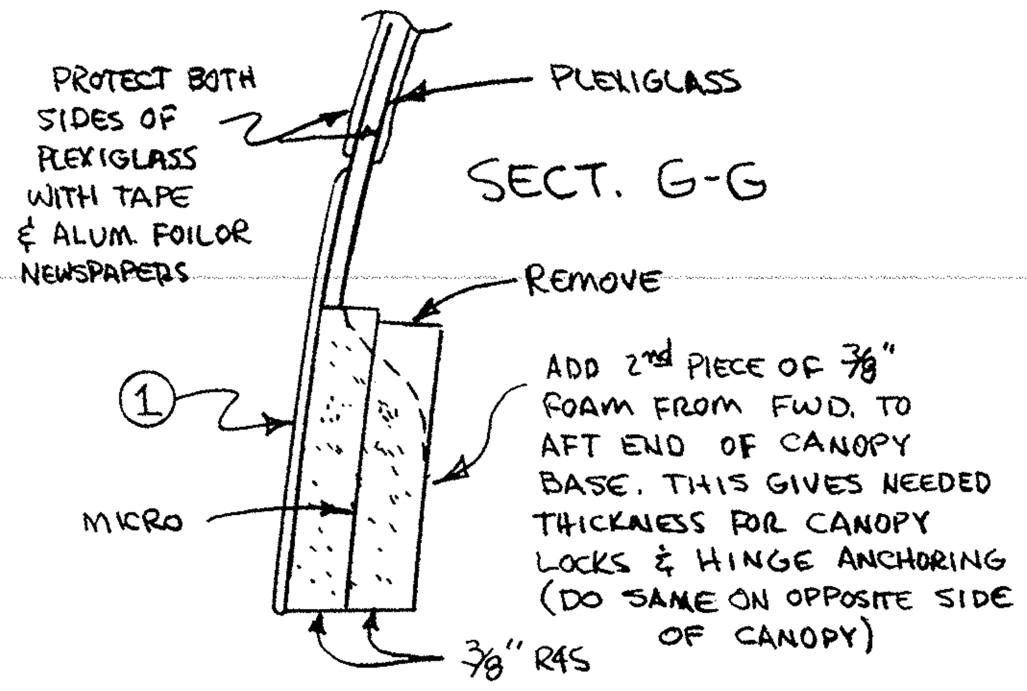
~ IMPORTANT ~
BOND ALL STRINGERS & FOAM TO FUSELAGE LIGHTLY. TURTLE DECK COMES OFF AFTER GLASSING OUTSIDE SKIN - LAYUP ①

SETUP CANOPY TO FIT YOUR PHYICAL HEIGTH AND PREFERENCE (2nd PROTOTYPE USED WL 71"). TEMPORARILY BOND A 5/8" R45 FOAM PIECE (FALSE BKHD) TO REAR HEAD REST AND USING A LONG STRAIGHT EDGE AS A LINE FROM THE CANOPY TO THE AFT FIREWALL CAREFULLY SHAPE THE FALSE BKHD (5/8 FOAM PIECE) TO NICE CONTOUR BETWEEN YOUR CANOPY AND FIREWALL. PLACE TEMPORARY 1/2"x1" WOOD STRINGERS BETWEEN CANOPY AND FIREWALL TO AID IN FORMING 3/8" R45 FOAM TURTLE DECK. USE PHOTO'S TO ILLUSTRATE CONSTRUCTION OF DECK. HEAT INSIDE SURFACE OF 3/8" R45 FOAM WITH HAIR DRYER TO HELP FORM FOAM. TORSIONAL STRENGTH OF FUSELAGE (TUB) BEFORE TURTLE DECK & FUEL TANKS ARE ADDED IS VERY WEAK. POSITION FUSELAGE TUB LEVEL (NO TWIST) BEFORE BUILDING DECK.

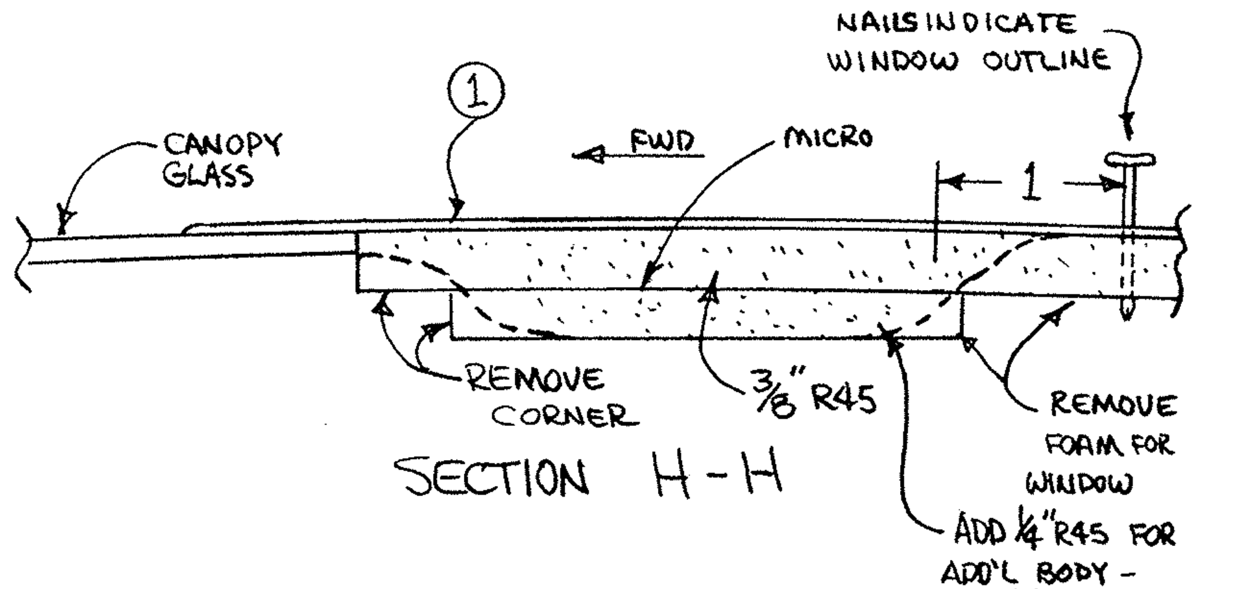
(SLURRY ALL FOAM)


FWD. CANOPY OPENING LINE TRANSFERRED TO INSIDE VIA 1/16" HOLES
ADD 2ND PLY OF 3/8" R45 ALONG CANOPY BASE (BOTH SIDES) SEE SECT G-G
CENTER LINE IS CANOPY OPENING LINE TRANSFERRED TO INSIDE SURFACE BY 1/16" DRILL HOLES.
ADD 1/4" R45
H
H
9" DIA. (SEE SECT F-F)
PLYWOOD INSERT
BL 11
D
D
E
E
1"x.049 2024-T3 ALUM
C
C
PLEXIGLASS CANOPY TRIM & SAND EDGE BEFORE GLASSING
F
F
I
I
BL 11
ADD 1/4" R45
G
G
ON SIDE WINDOWS REMOVE FOAM DOWN TO OUTSIDE SKIN ① AND 1" LARGER THEN OUTLINE TRANFERRED VIA 1/16 HOLES (TYPICAL 4 WINDOWS)
UPSIDE DOWN (TURTLE DECK)
(AFT SIDE) BUTT AGAINST "OPENING LINE" A 1.7" WIDE STRIP OF 3/8" R45 FOAM - MICRO STRIP IN PLACE. SEE SECTION C-C FOR SHAPE OF STRIPS
FWD. SIDE OF "OPENING LINE" BUTT A 1.7" WIDE STRIP OF 1/4" R45 - SEE SECT. C-C DO NOT JOIN 1/4" AND 3/8" STRIPS TOGETHER

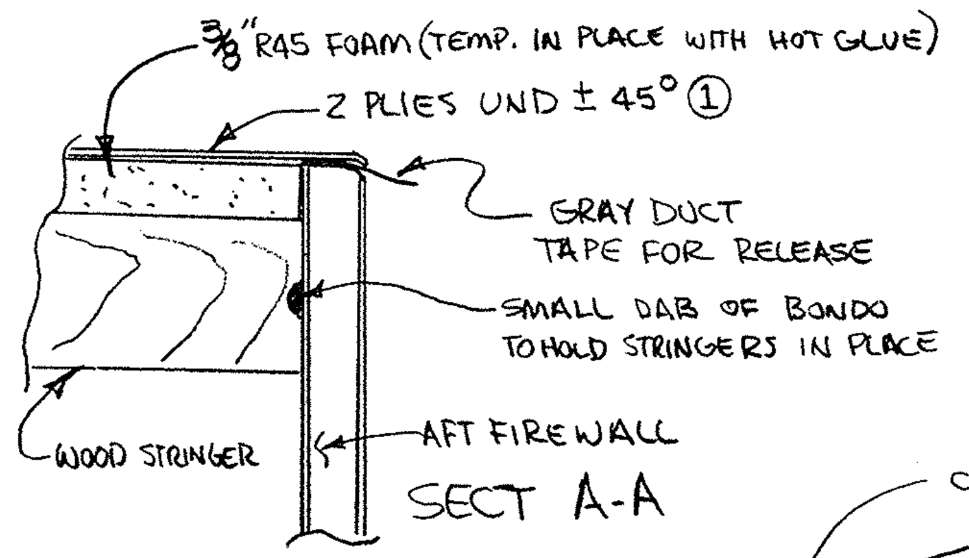
INSIDE SURFACE VIEW OF TURTLE DECK


PROTECT BOTH SIDES OF PLEXIGLASS WITH TAPE & ALUM FOIL OR NEWSPAPERS
PLEXIGLASS
REMOVE
①
ADD 2nd PIECE OF 3/8" FOAM FROM FWD. TO AFT END OF CANOPY BASE. THIS GIVES NEEDED THICKNESS FOR CANOPY LOCKS & HINGE ANCHORING (DO SAME ON OPPOSITE SIDE OF CANOPY)
MICRO
3/8" R45

SECT. G-G

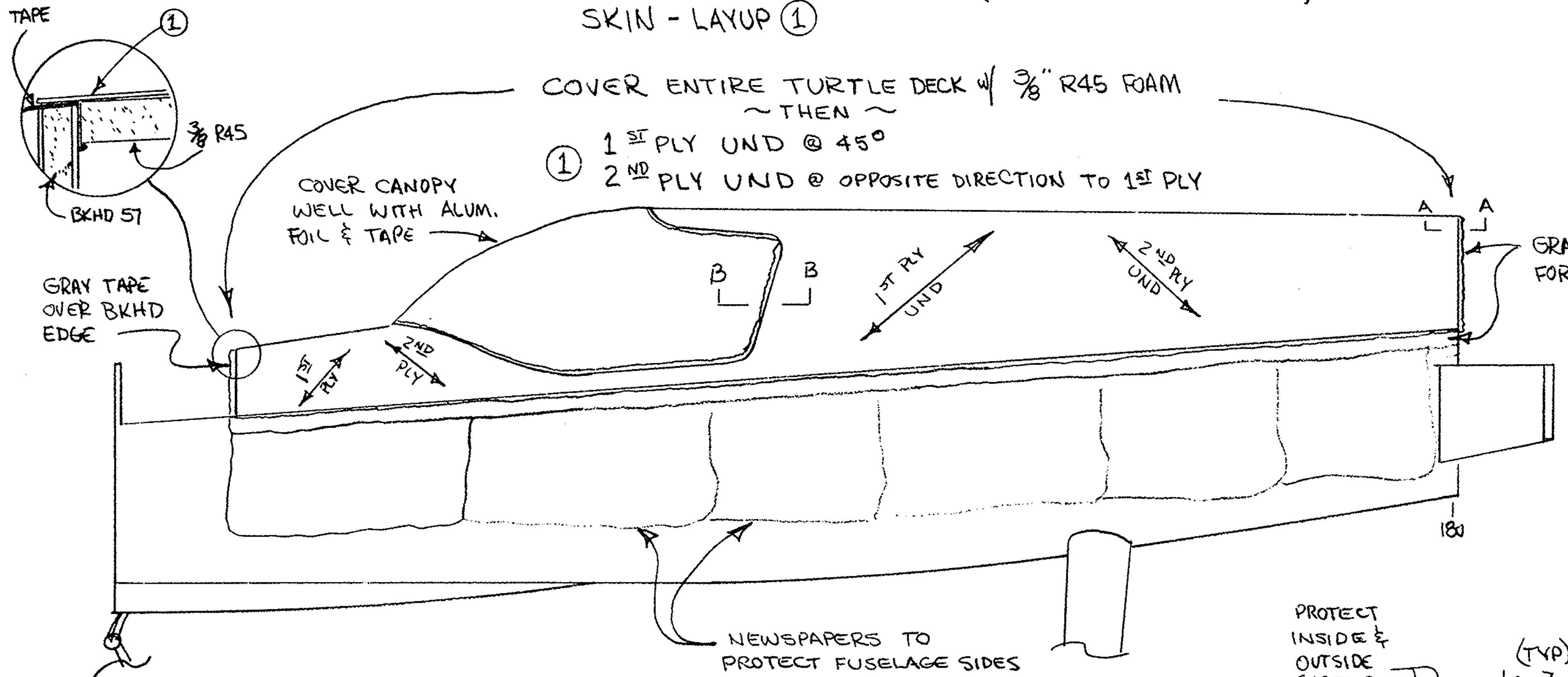

NAILS INDICATE WINDOW OUTLINE
CANOPY GLASS
①
FWD
MICRO
1
REMOVE CORNER
3/8" R45
REMOVE FOAM FOR WINDOW
ADD 1/4" R45 FOR ADD'L BODY - EA. SIDE

SECTION H-H

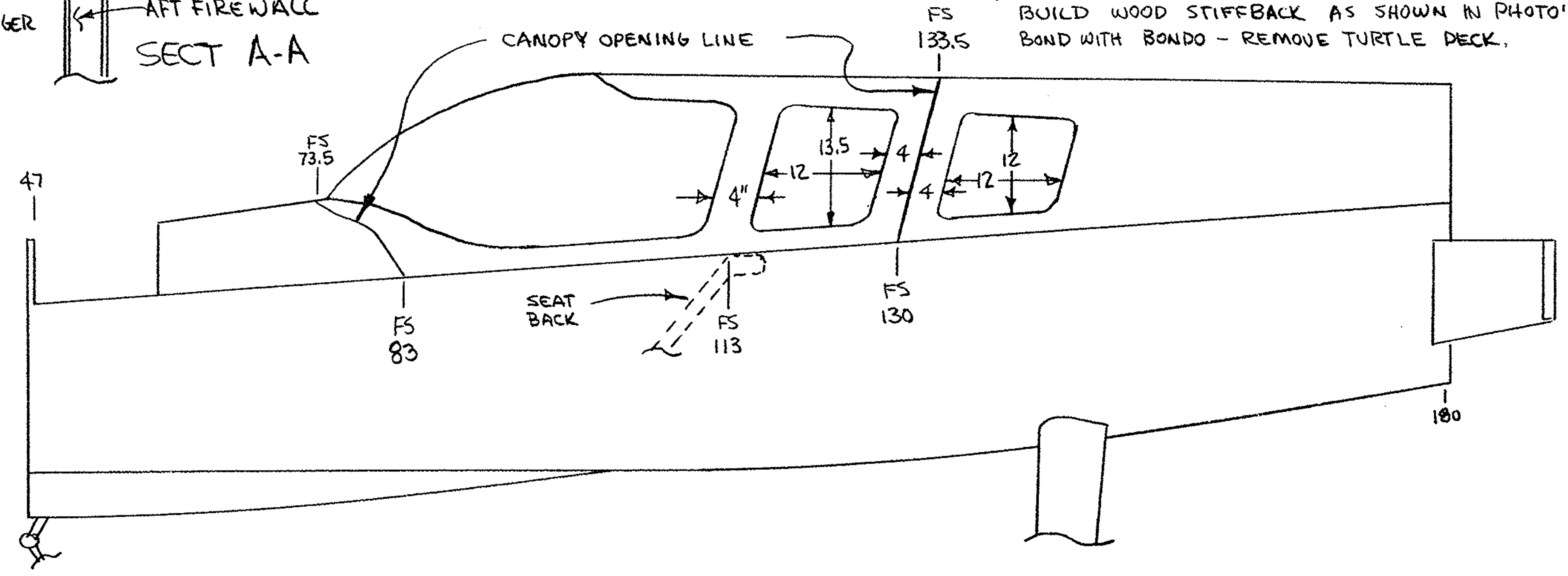

3/8" R45 FOAM (TEMP. IN PLACE WITH HOT GLUE)
2 PLIES UND ± 45° ①
GRAY DUCT TAPE FOR RELEASE
SMALL DAB OF BONDO TO HOLD STRINGERS IN PLACE
WOOD STRINGER
AFT FIREWALL

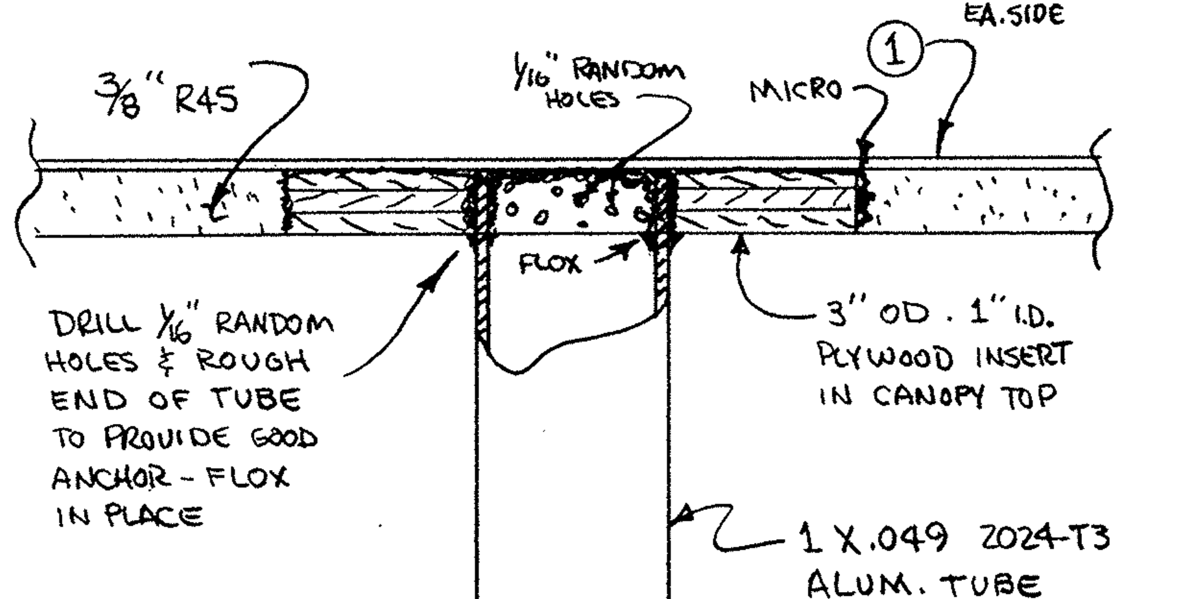
SECT A-A

COVER ENTIRE TURTLE DECK w/ 3/8" R45 FOAM
~ THEN ~
① 1ST PLY UND @ 45°
2ND PLY UND @ OPPOSITE DIRECTION TO 1ST PLY

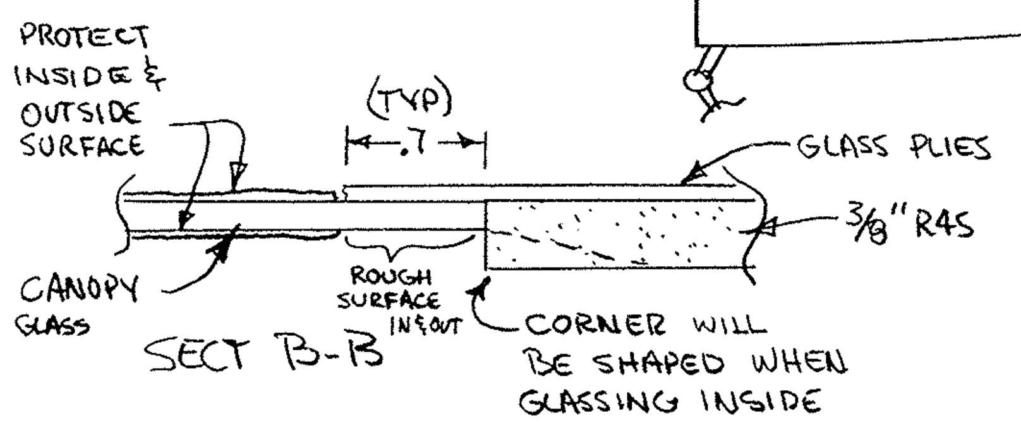


MARK OUTLINE WITH INK PEN OF SIDE WINDOWS AND CANOPY OPENING TO SUIT YOUR PREFERENCE OR TO DIMENSIONS USED ON PROTOTYPE. DRILL 1/16" HOLES THRU TURTLE DECK INSIDE OF WINDOW OUTLINE & ALONG CANOPY OPENING LINE (2" SPACE) TO TRANSFER REFERENCE TO INSIDE OF DECK. BUILD WOOD STIFFBACK AS SHOWN IN PHOTO'S - BOND WITH BONDO - REMOVE TURTLE DECK.




3/8" R45
1/16" RANDOM HOLES
MICRO
①
FLOX
DRILL 1/16" RANDOM HOLES & ROUGH END OF TUBE TO PROVIDE GOOD ANCHOR - FLOX IN PLACE
3" OD. 1" I.D. PLYWOOD INSERT IN CANOPY TOP
1 X .049 2024-T3 ALUM. TUBE

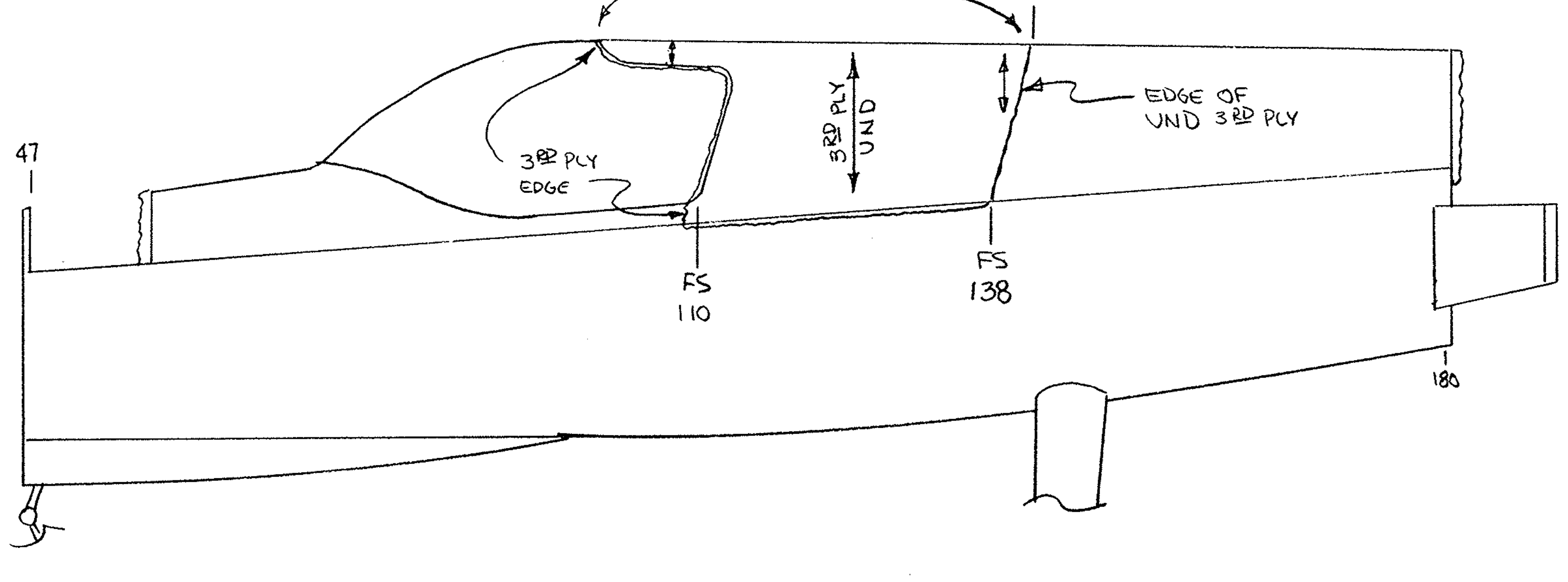
SECT. I-I
RIGHT SIDE UP



SECT B-B

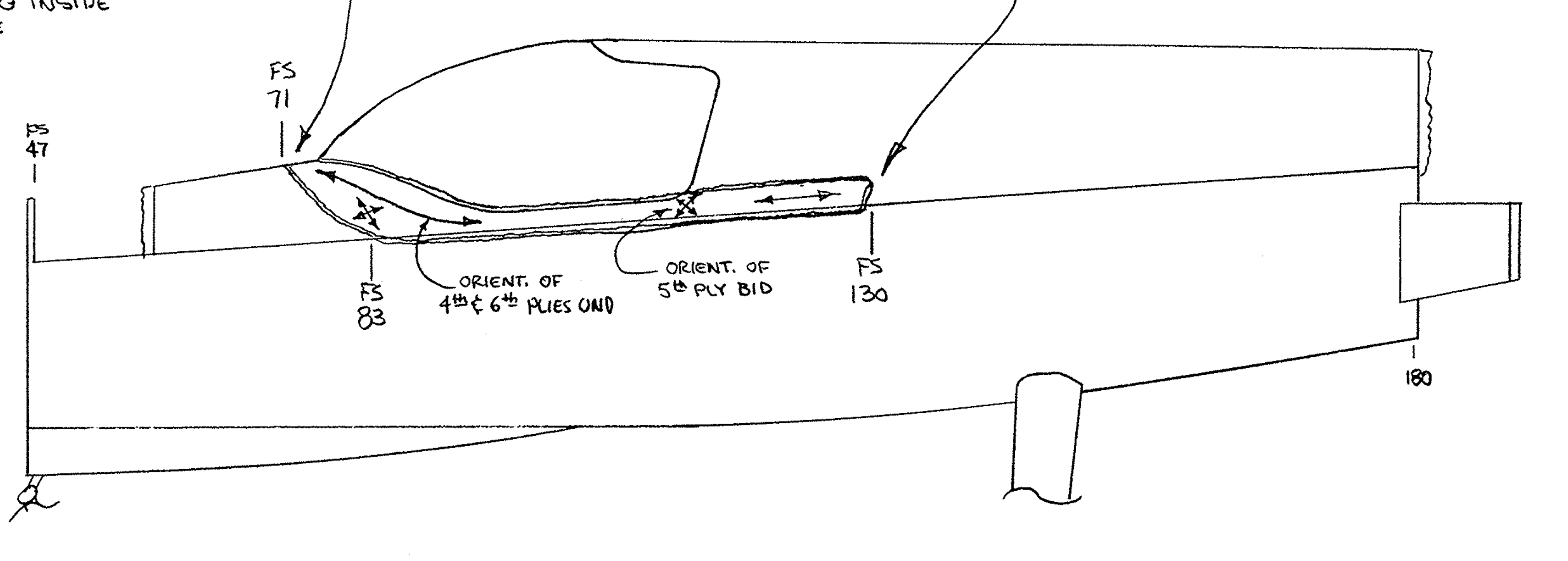
CORNER WILL BE SHAPED WHEN GLASSING INSIDE SURFACE

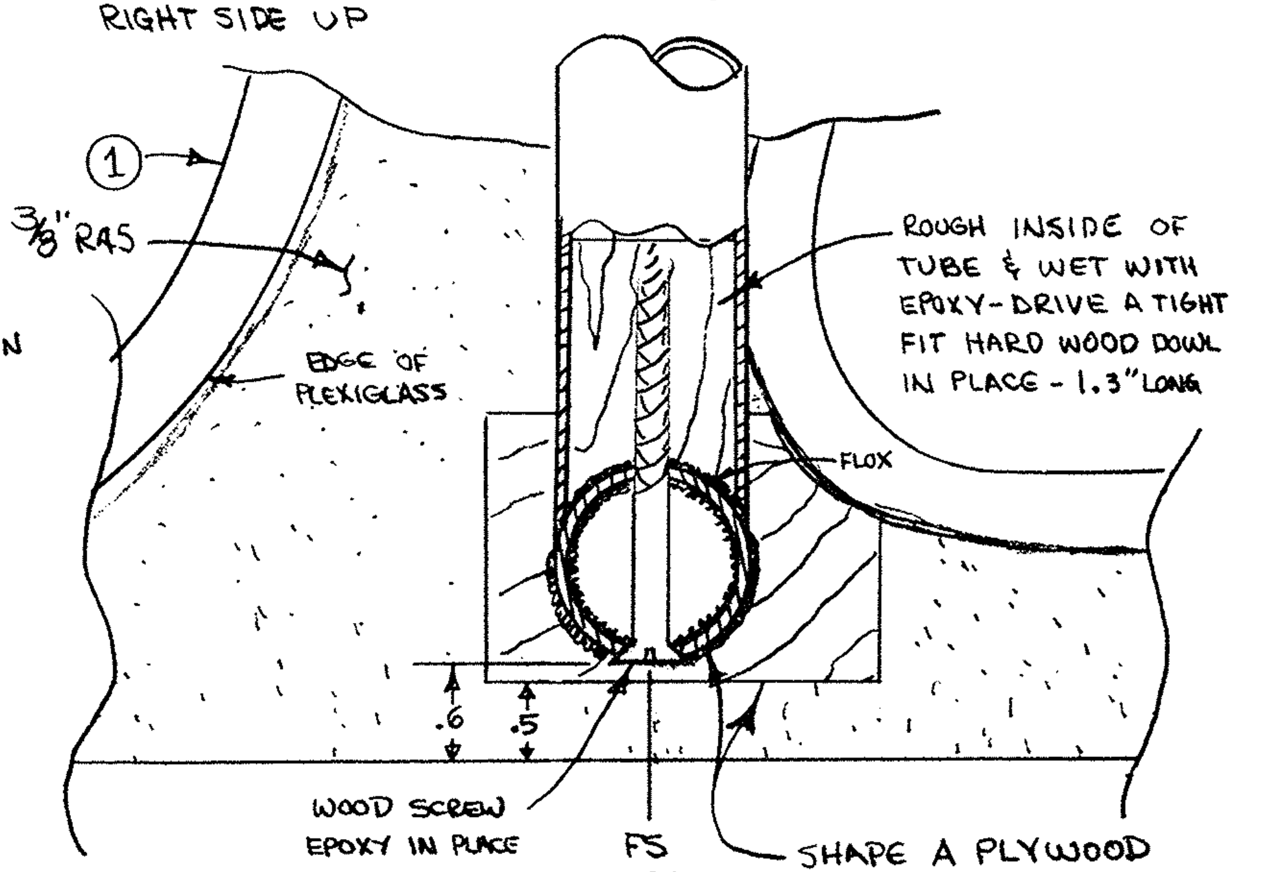
① 3RD PLY
1 PLY UND @ ORIENT. SHOWN (90°)



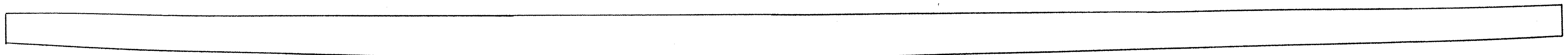
① 4th PLY 1 UND @ ORIENT. SHOWN
5th PLY 1 BID @ 45°
6th PLY 1 UND @ ORIENT. SHOWN

AFTER COMPLETION OF 6th PLY RECHECK FUSELAGE ALIGNMENT (NO TWIST) - STRAIGHTEN IF NEEDED AND ALLOW 48 HOUR CURE BEFORE REMOVING DECK.

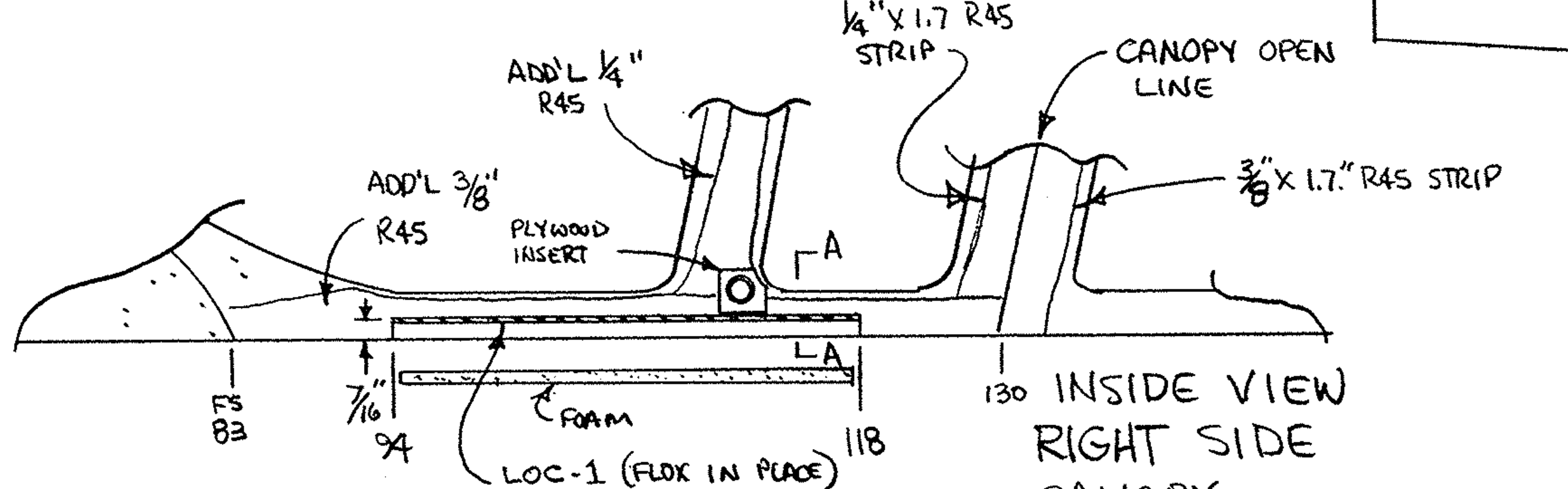



①
3/8" R45
EDGE OF PLEXIGLASS
ROUGH INSIDE OF TUBE & WET WITH EPOXY - DRIVE A TIGHT FIT HARD WOOD DOWL IN PLACE - 1.3" LONG
FLOX
.6
.5
WOOD SCREW EPOXY IN PLACE
FS 113.5
SHAPE A PLYWOOD INSERT TO FIT YOUR CONTOUR TO HOLD 1X.049 2024-T3 ALUM TUBE - MICRO PLYWOOD IN PLACE - FLOX TUBE INTO PLYWOOD

RIGHT SIDE CANOPY

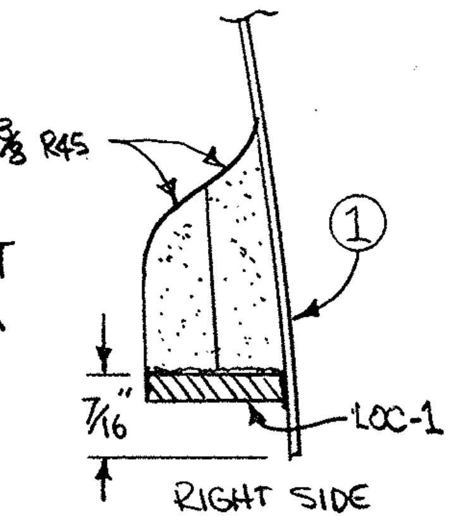


LOC-1 .125 2024-T3 ALUM. (MAKE ONE) FULL SIZE
"CANOPY HINGE BOLT ANCHOR PLATE"



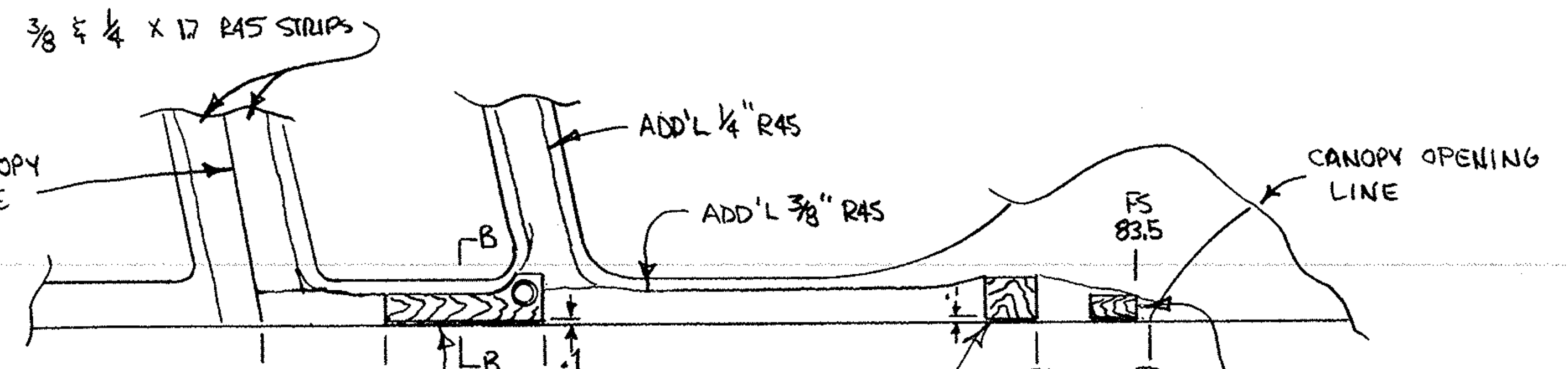
INSIDE VIEW
RIGHT SIDE
CANOPY

REMOVE 7/16" FOAM BETWEEN FS 94 & 118 - FLOX IN PLACE LOC-1 & TEMPORARILY REPLACE REMOVED FOAM UNTIL INSIDE OF CANOPY IS GLASSED.



SECT
A-A

RIGHT SIDE

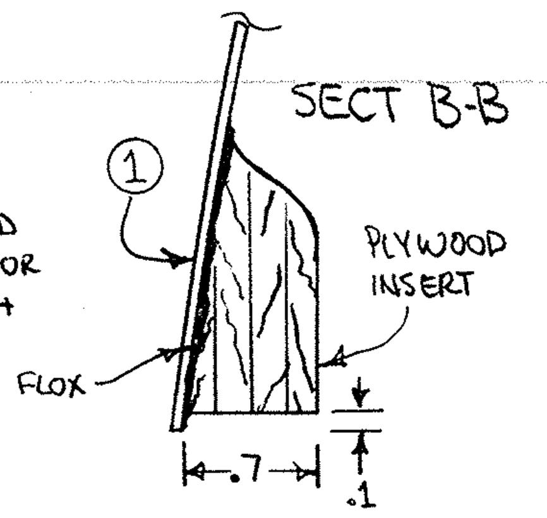


INSIDE VIEW
LEFT SIDE
CANOPY

MAKE PLYWOOD INSERT TO LENGTH AND PLACEMENT AS SHOWN - FLOX IN PLACE - THIS INSERT SERVES AS CROSS-BAR (1X.049 TUBE) & CANOPY LOCK ANCHORS

2"X2" PLYWOOD INSERT - USED FOR FWD CANOPY LOCK ANCHOR

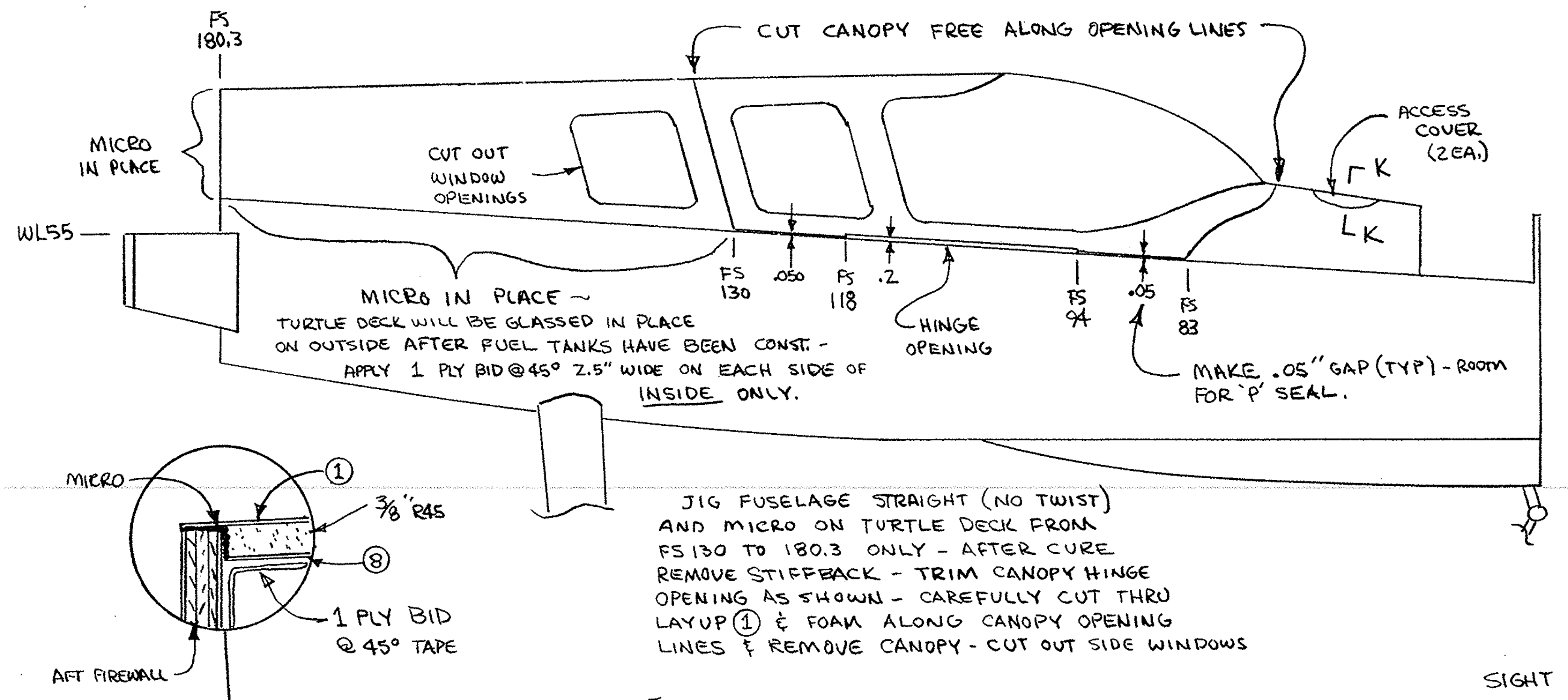
1"X2" PLYWOOD INSERT - USE FOR SAFETY CATCH ANCHOR



SECT B-B

DIMENSIONS ARE TYPICAL EACH INSERT.

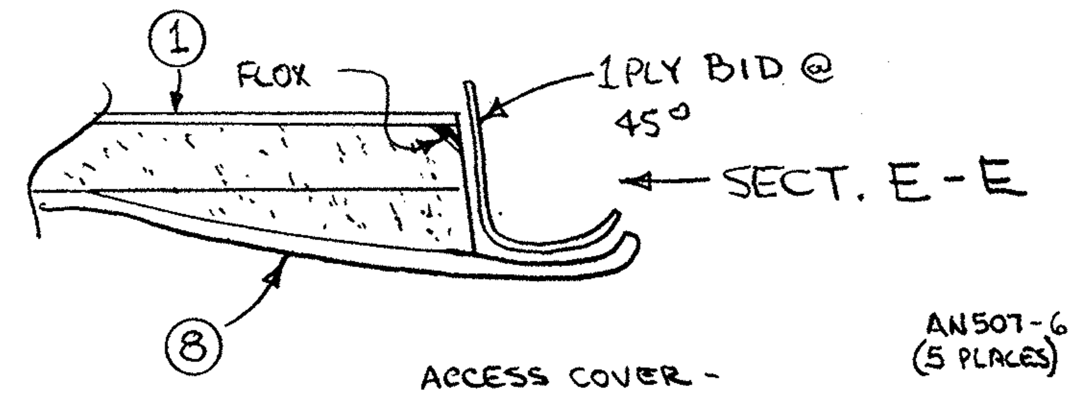
LEFT SIDE



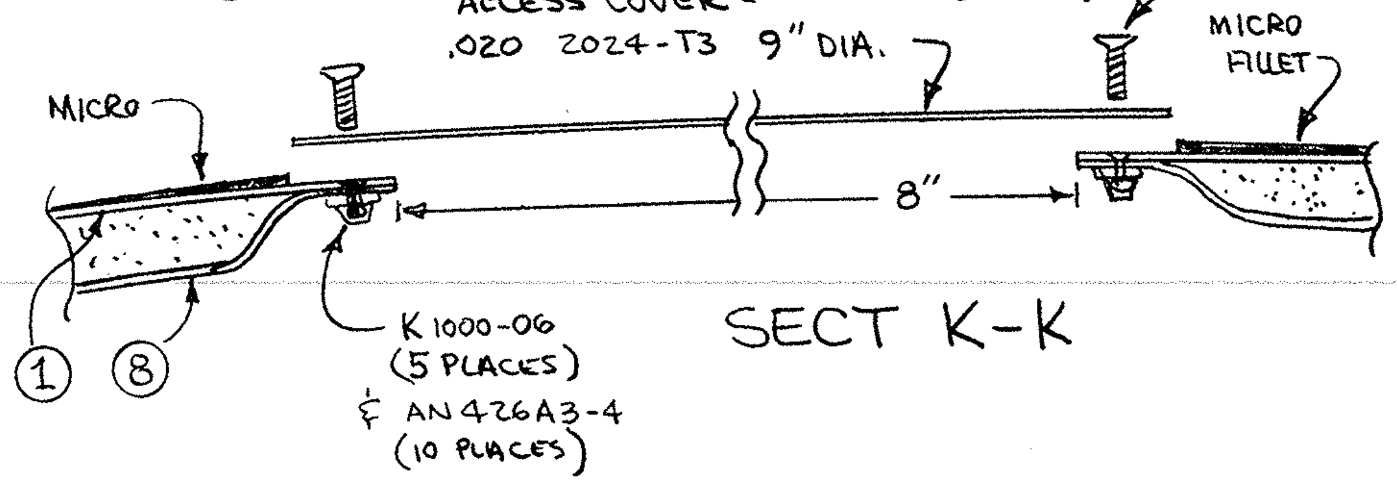
MICRO IN PLACE ~
TURTLE DECK WILL BE GLASSED IN PLACE ON OUTSIDE AFTER FUEL TANKS HAVE BEEN CONST. - APPLY 1 PLY BID @45° 2.5" WIDE ON EACH SIDE OF INSIDE ONLY.

MAKE .05" GAP (TYP) - ROOM FOR 'P' SEAL.

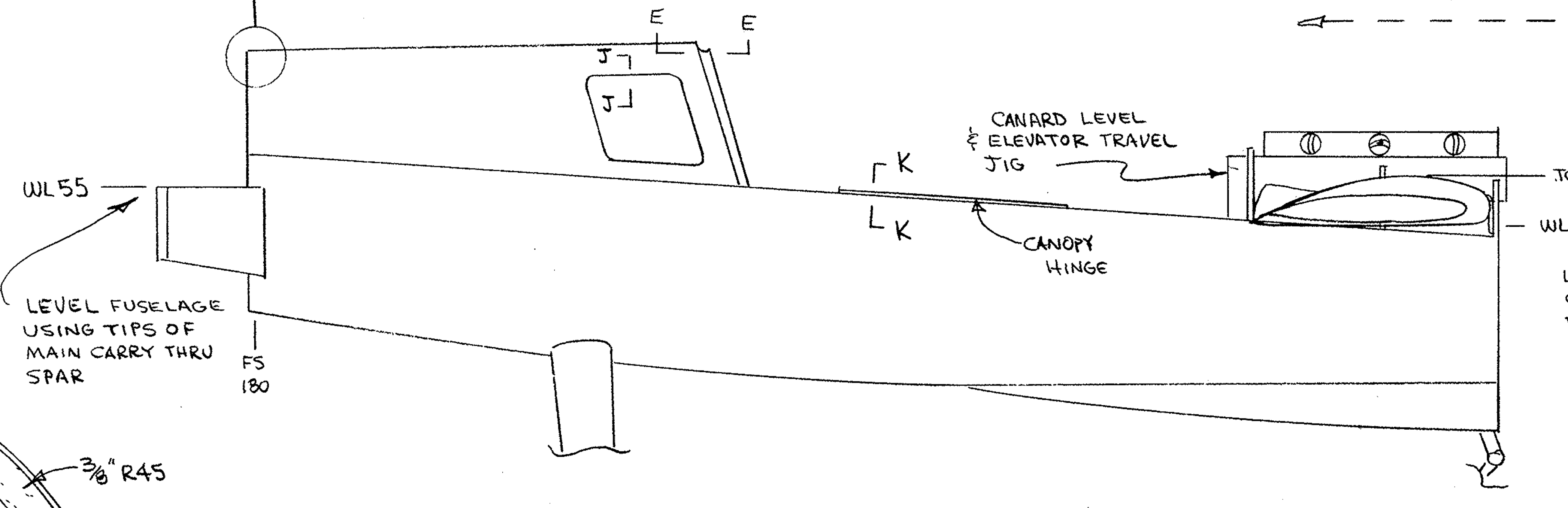
JIG FUSELAGE STRAIGHT (NO TWIST) AND MICRO ON TURTLE DECK FROM FS 130 TO 180.3 ONLY - AFTER CURE REMOVE STIFFBACK - TRIM CANOPY HINGE OPENING AS SHOWN - CAREFULLY CUT THRU LAYUP ① & FOAM ALONG CANOPY OPENING LINES & REMOVE CANOPY - CUT OUT SIDE WINDOWS



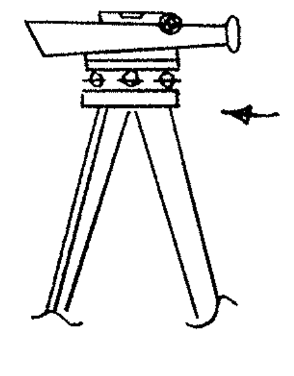
SECT. E-E


ACCESS COVER - .020 2024-T3 9" DIA.
AN507-632R6 (5 PLACES)
MICRO FILLET
MICRO
8"
① ⑧
K1000-06 (5 PLACES) & AN426A3-4 (10 PLACES)

SECT K-K


E E
J
J
K
K
CANARD LEVEL & ELEVATOR TRAVEL JIG
CANOPY HINGE
WL55
TOP OF CANARD WL 52.7 @ BL '0'
WL 48.2 (CANARD FWD LIFT POINT)
FS 180
SIGHT LEVEL LINE

LEVEL FUSELAGE USING TIPS OF MAIN CARRY THRU SPAR



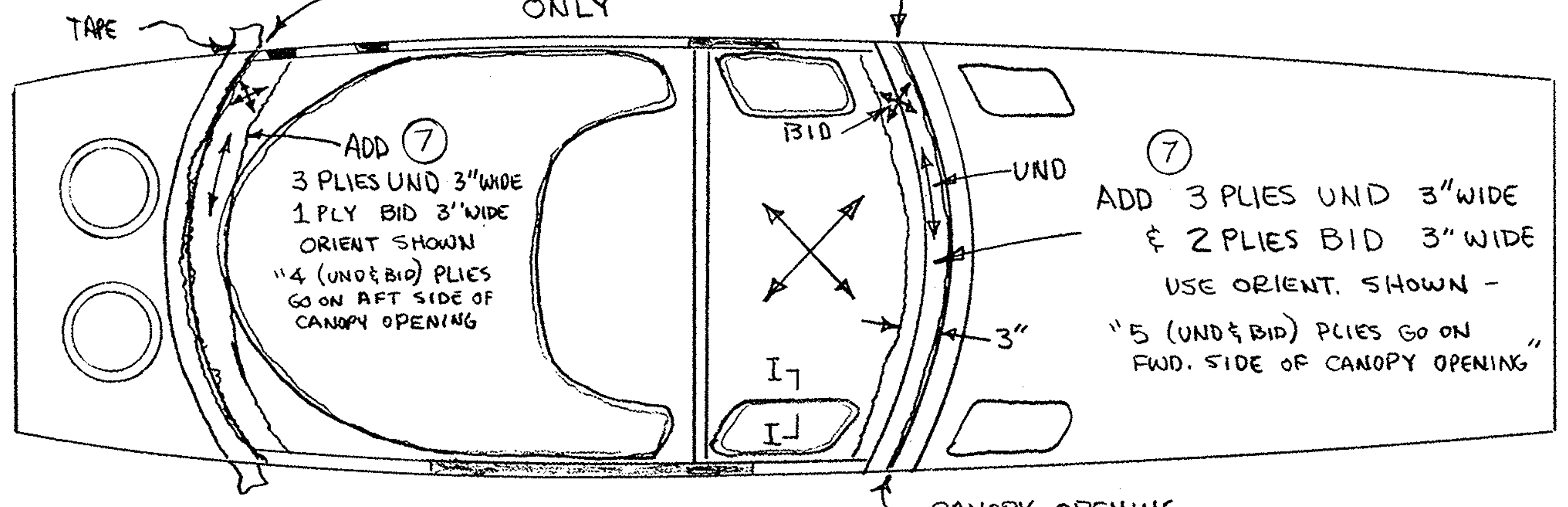
USE THIS METHOD ONLY

LEVEL FUSELAGE IN ALL DIRECTIONS & ELEVATE CANARD TO REQ'D WATER LINE - LEVEL CANARD -

BE CAREFUL - HAVE SOMEONE CHECK YOUR WORK - DON'T RUSH

AFTER ALIGNED BONDO IN PLACE & DRILL ¼" HOLE IN BKHD 57 THRU INTO LIFT TAB (REAR LIFT ATCH POINT IS WL 46.7) (FWD. LIFT ATCH POINT IS WL 48.2) DRILL ¼" THRU FIREWALL INTO FORWARD LIFT TABS. NOW, USING ⅝" SPOTFACE BORE OUT AFT LIFT POINTS TO ⅝" DIA. REMOVE CANARD & INSTALL ATCH HARDWARE & REINSTALL CANARD WITH REQ'D BOLTS - FIT & INSTALL ELEVATORS FOR FULL TRAVEL (12° UP - 20° DOWN) - ADJ CONTROL LINKAGE IN FUSELAGE FOR REQ'D TRAVEL & SMOOTH OPERATION. SEE D-26 FOR DETAIL

⑦ 2 PLIES BID @ 45°
INSIDE CANOPY PORTION ONLY

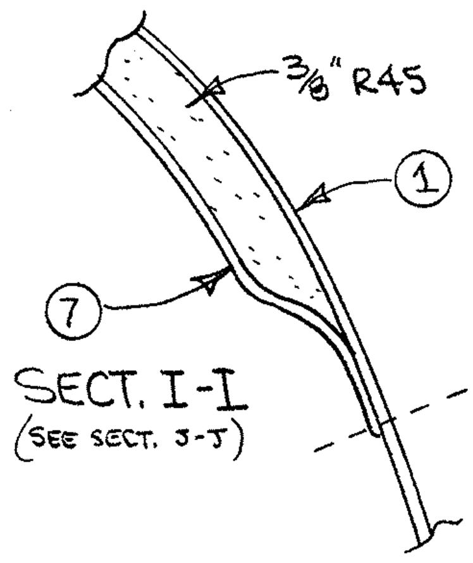


ADD ⑦
3 PLIES UND 3" WIDE
1 PLY BID 3" WIDE
ORIENT SHOWN
"4 (UND & BID) PLIES GO ON AFT SIDE OF CANOPY OPENING

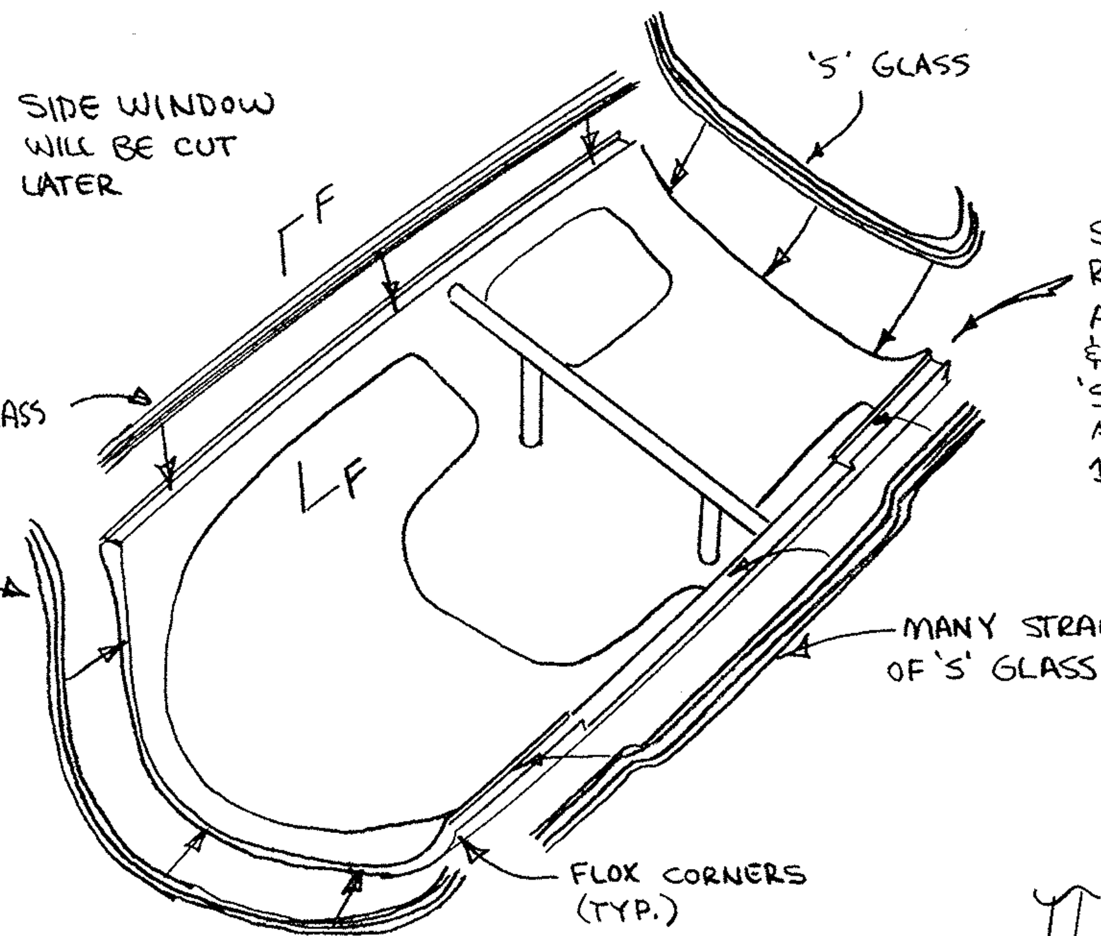
⑦
ADD 3 PLIES UND 3" WIDE
& 2 PLIES BID 3" WIDE
USE ORIENT. SHOWN -
"5 (UND & BID) PLIES GO ON FWD. SIDE OF CANOPY OPENING"

CANOPY OPENING LINE

TOP VIEW
TURTLE DECK
UPSIDE DOWN

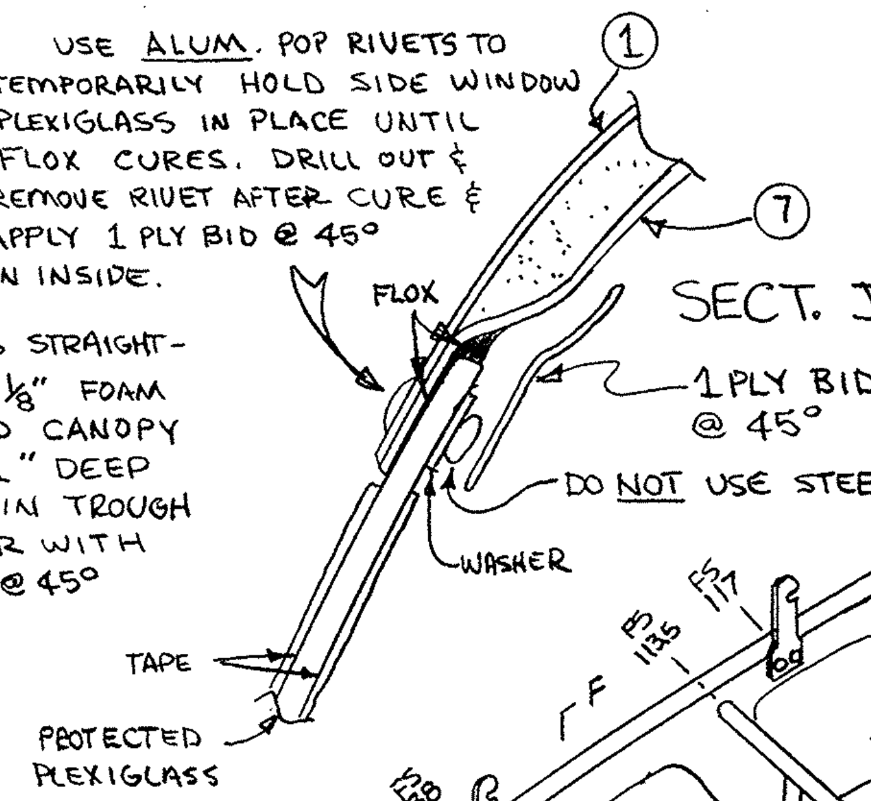


SECT. I-I
(SEE SECT. J-J)



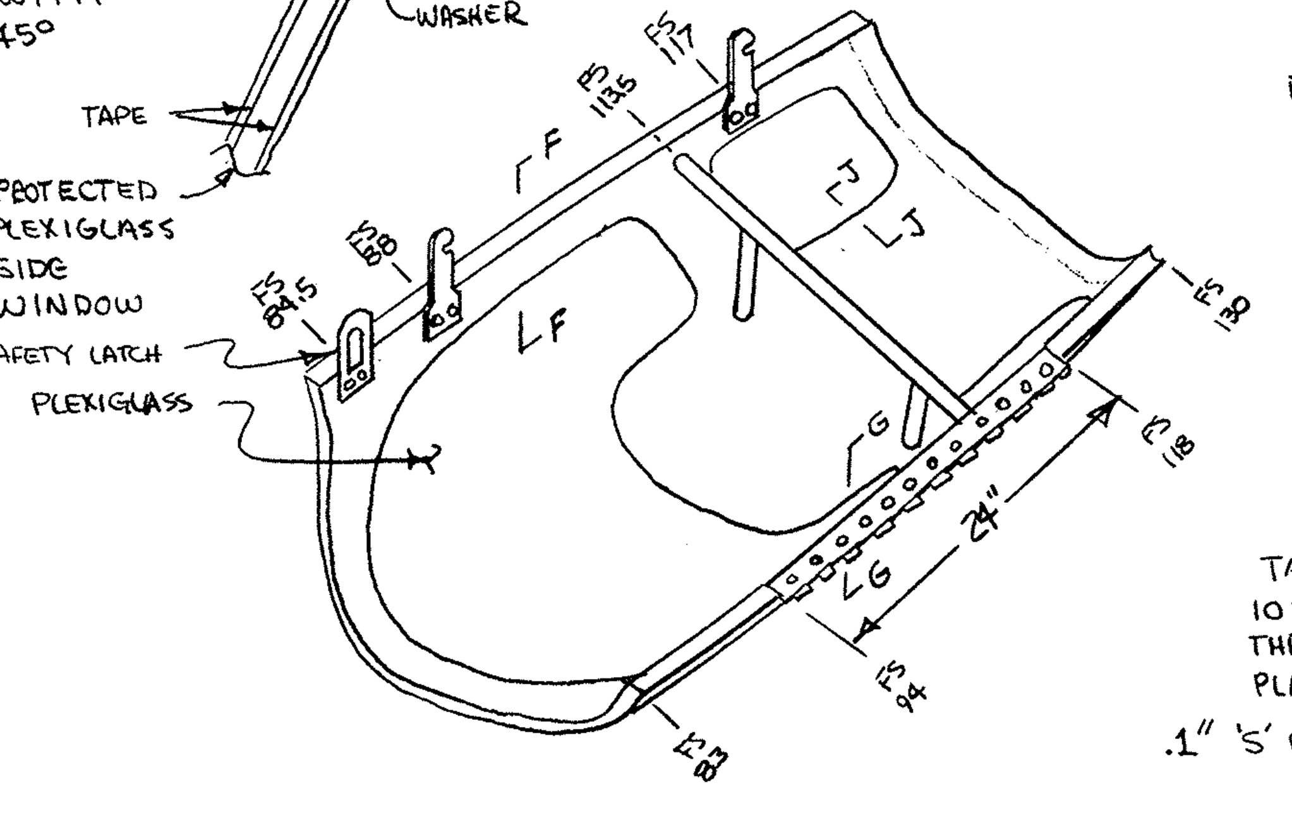
SAND EDGES STRAIGHT - ROUTE OUT ⅛" FOAM ALL AROUND CANOPY & LAY UP .1" DEEP 'S' GLASS IN TROUGH AND COVER WITH 1 PLY BID @ 45°

USE ALUM. POP RIVETS TO TEMPORARILY HOLD SIDE WINDOW PLEXIGLASS IN PLACE UNTIL FLOX CURES. DRILL OUT & REMOVE RIVET AFTER CURE & APPLY 1 PLY BID @ 45° ON INSIDE.

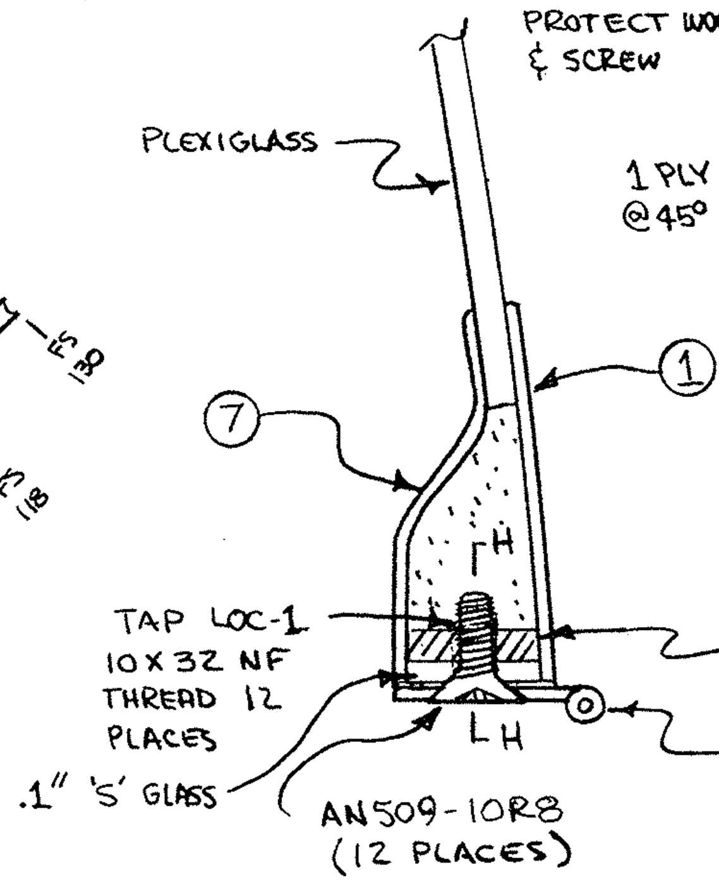


SECT. J-J (TYP. 4 WINDOWS)

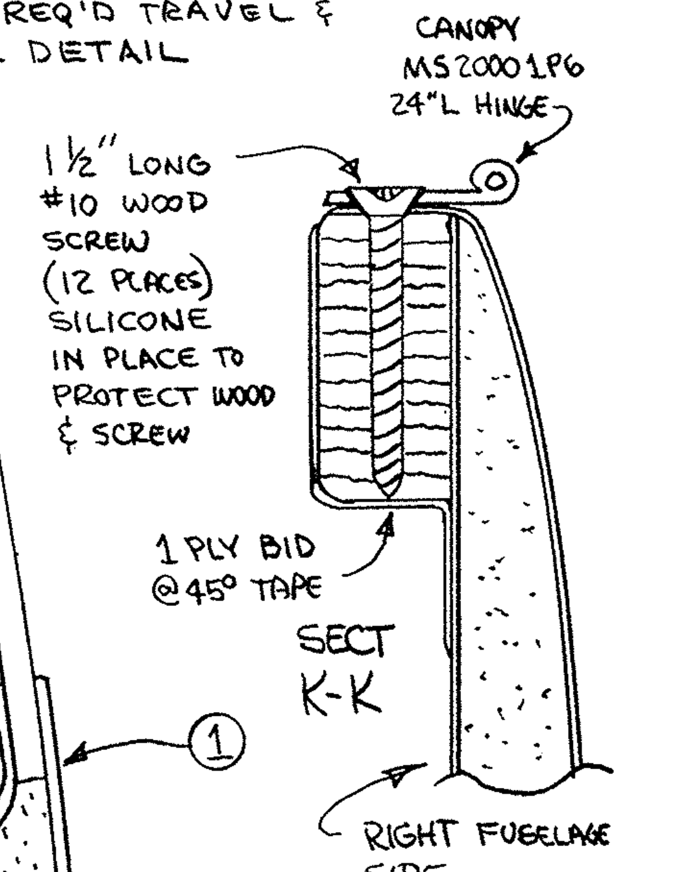
DO NOT USE STEEL RIVET, IT WILL CRACK PLEXIGLASS



CANOPY LAYOUT
(UP SIDE DOWN)



SECT G-G
(RIGHT SIDE UP)

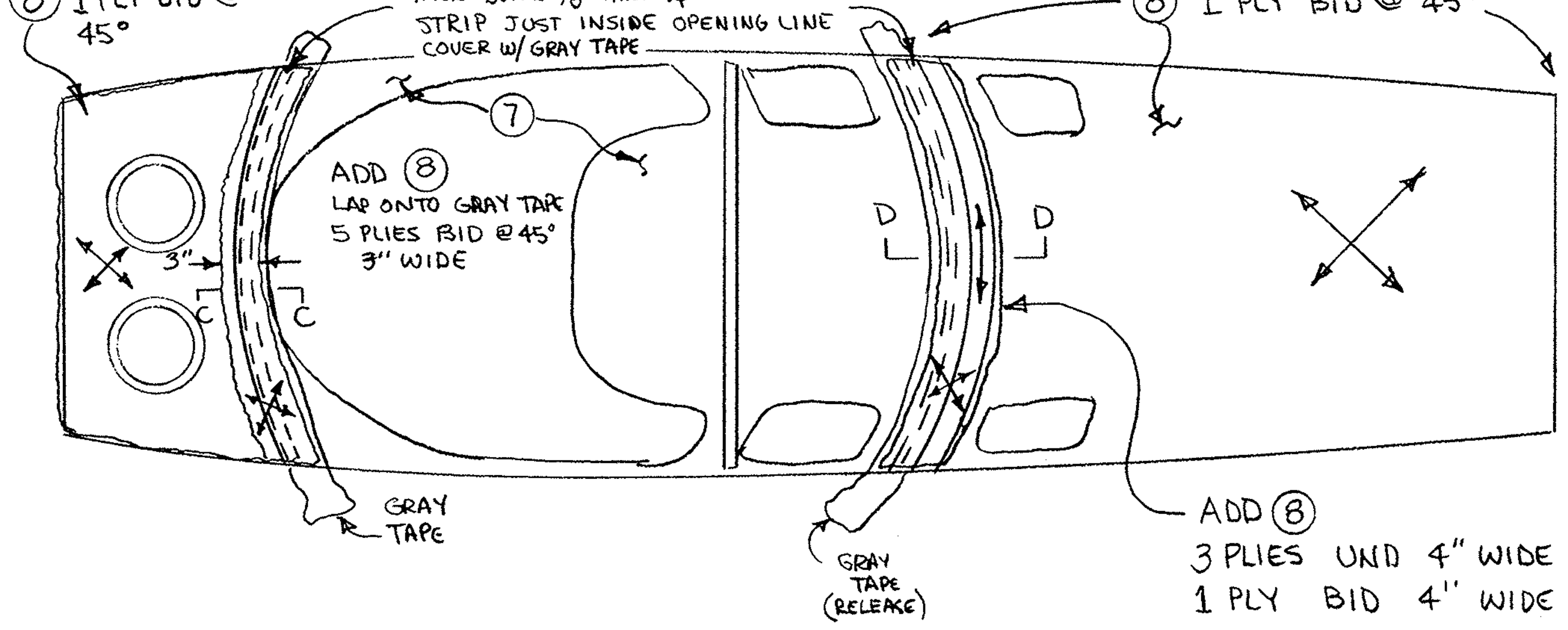

CANOPY MS20001P6 24"L HINGE
1½" LONG #10 WOOD SCREW (12 PLACES) SILICONE IN PLACE TO PROTECT WOOD & SCREW
1 PLY BID @45° TAPE
RIGHT FUSELAGE SIDE

SECT K-K

⑧ 1 PLY BID @ 45°

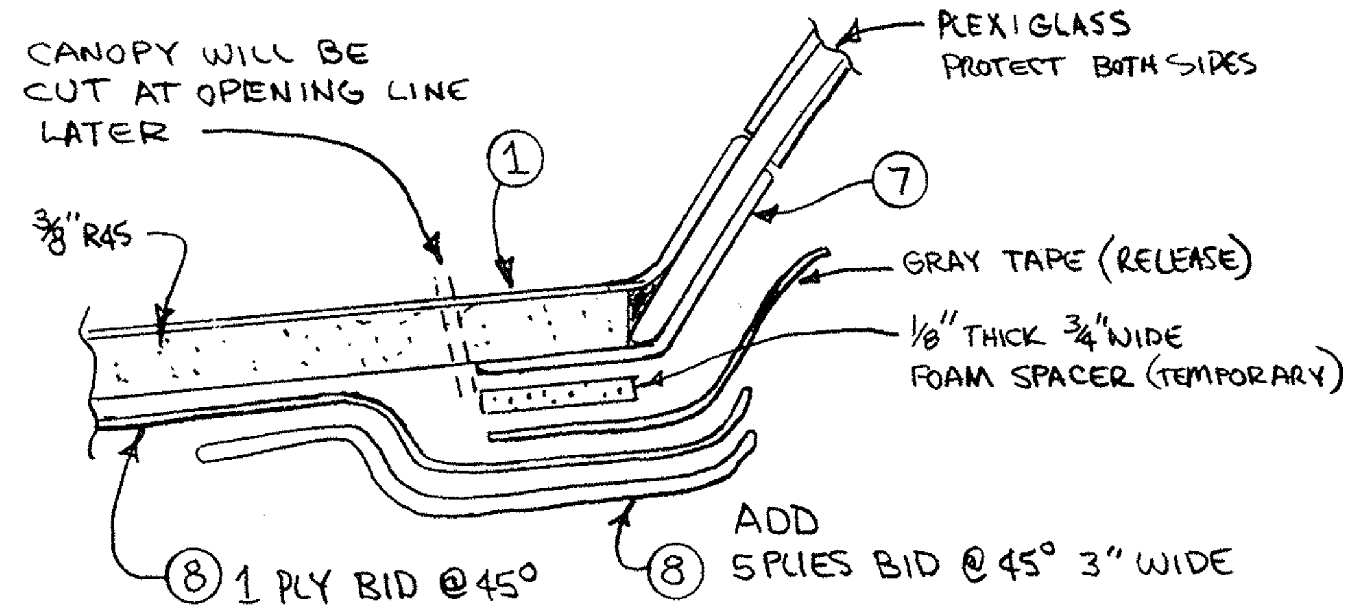
TACK DOWN ⅛" THICK ¾" WIDE R45 STRIP JUST INSIDE OPENING LINE COVER W/ GRAY TAPE

⑧ 1 PLY BID @ 45°

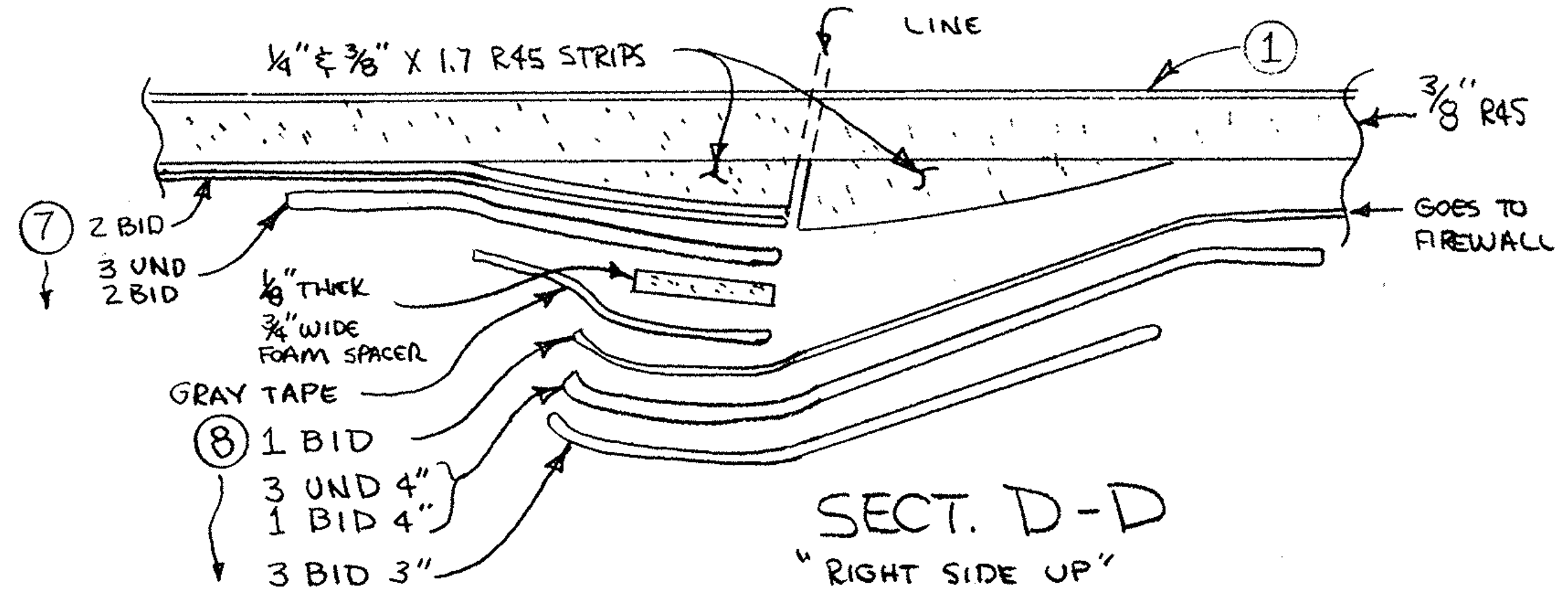


ADD ⑧
LAP ONTO GRAY TAPE
5 PLIES BID @45°
3" WIDE

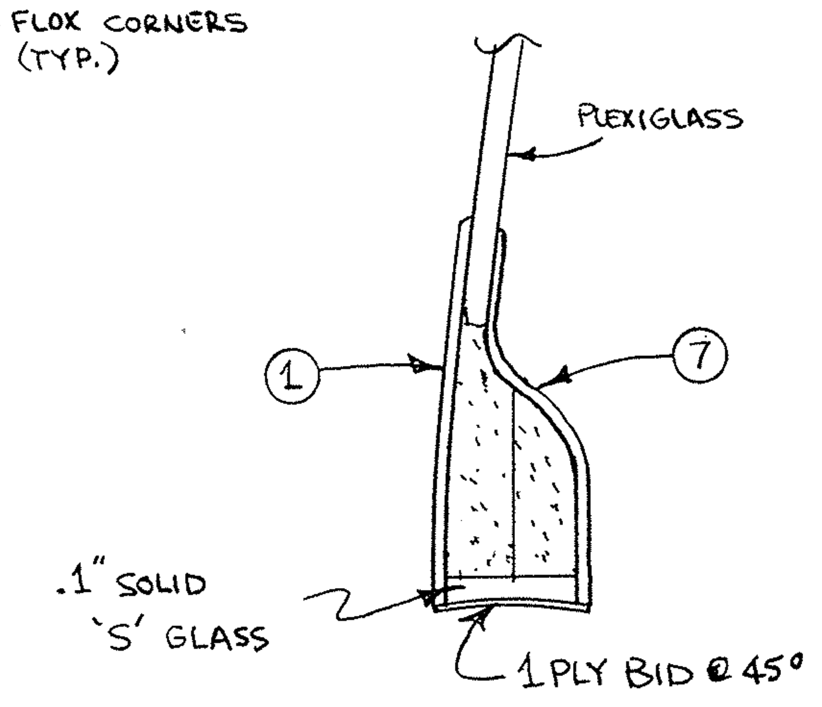
ADD ⑧
3 PLIES UND 4" WIDE @ ORIENT. SHOWN
1 PLY BID 4" WIDE @45°
3 PLIES BID 3" WIDE @45°


CANOPY WILL BE CUT AT OPENING LINE LATER
①
PLEXIGLASS PROTECT BOTH SIDES
⑦
⅜" R45
GRAY TAPE (RELEASE)
⅛" THICK ¾" WIDE FOAM SPACER (TEMPORARY)
⑧ 1 PLY BID @45°
ADD ⑧ 5 PLIES BID @45° 3" WIDE

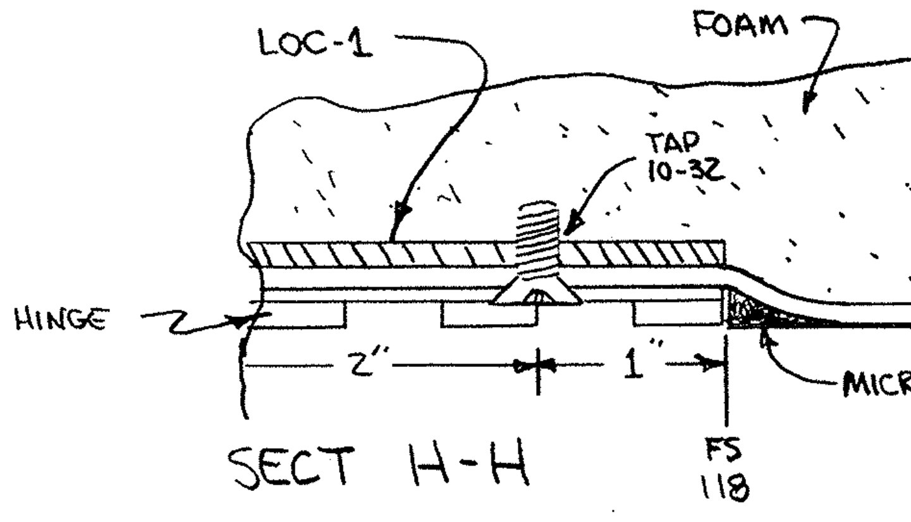
SECT C-C "RIGHT SIDE UP"



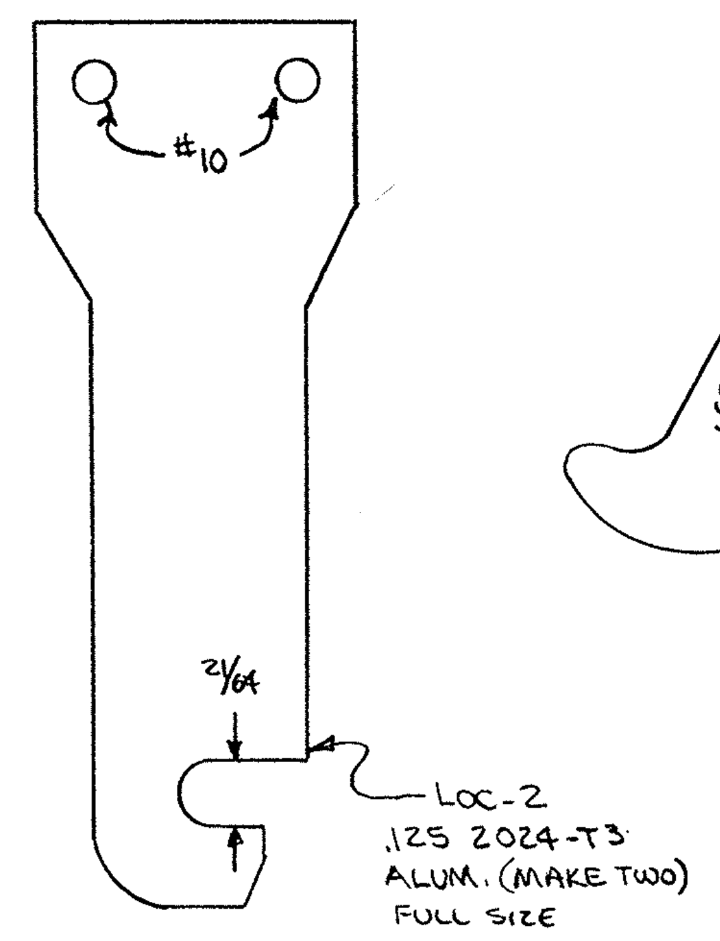
SECT. D-D
"RIGHT SIDE UP"

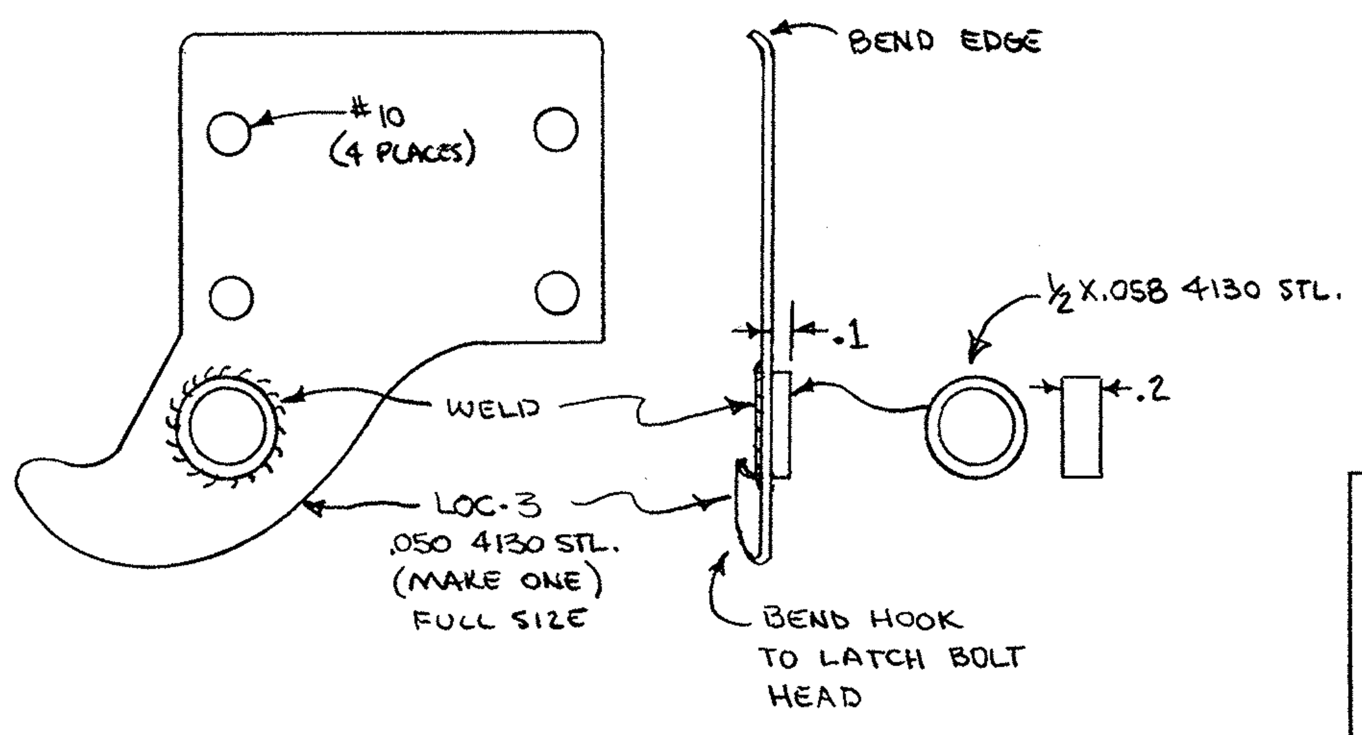


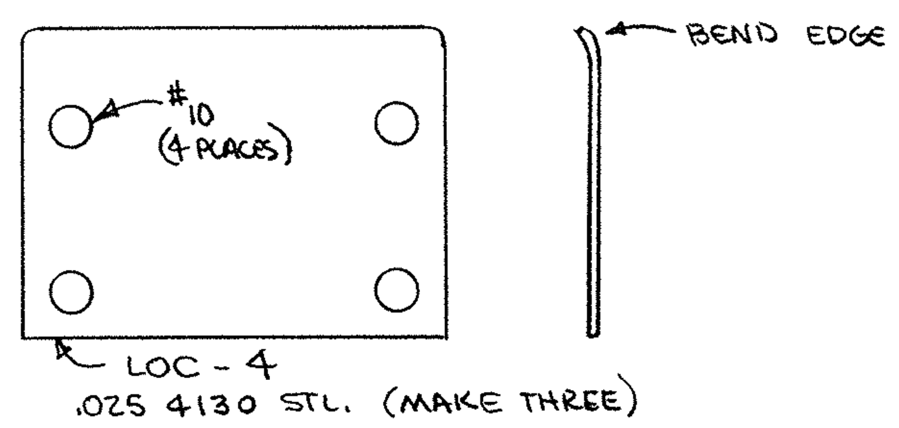
SECT. F-F (TYP.)

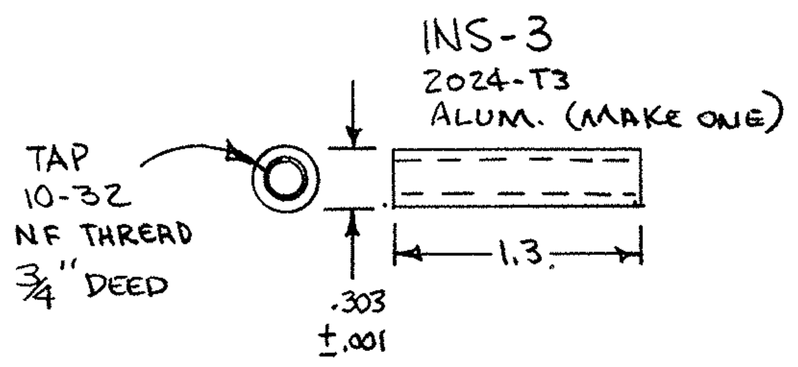


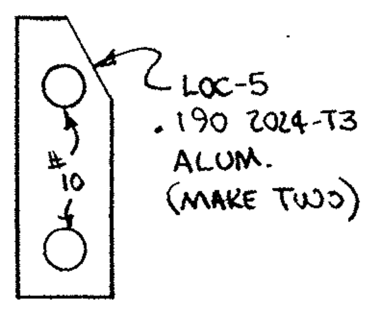
SECT H-H

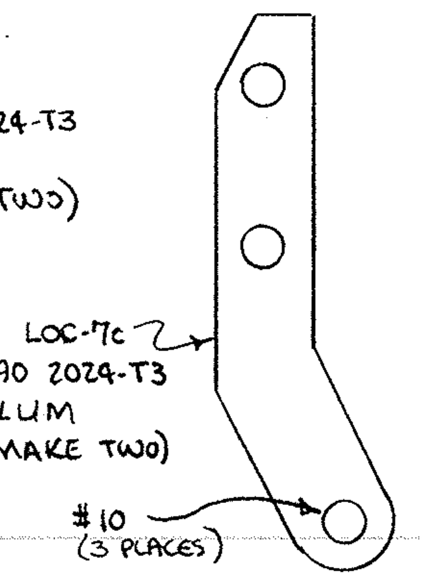


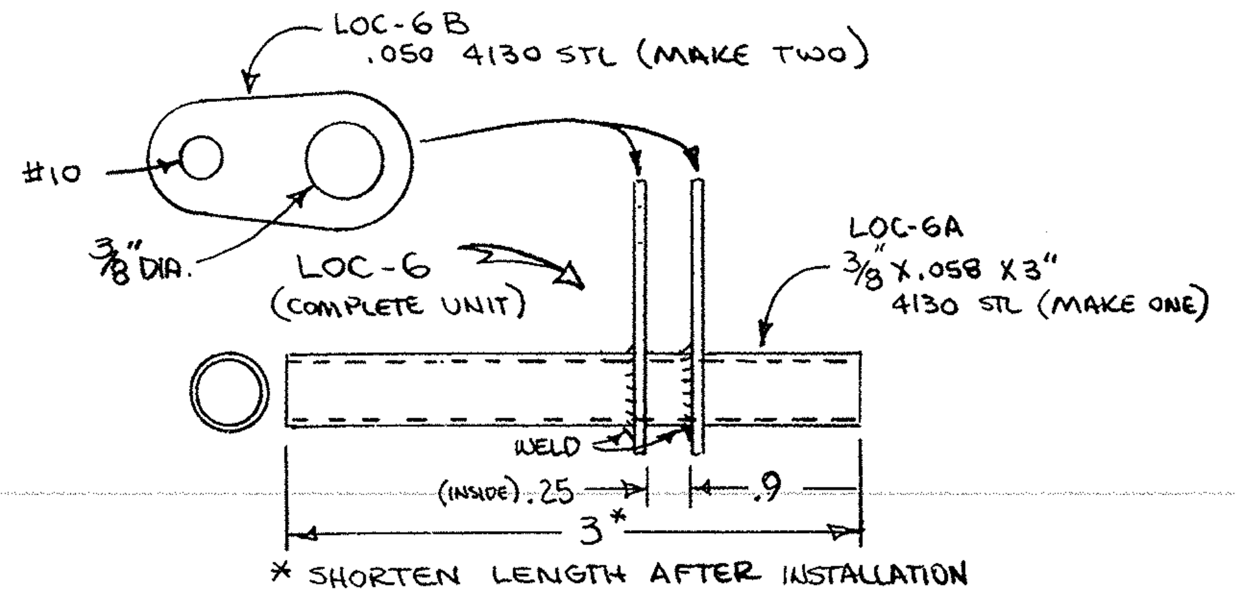


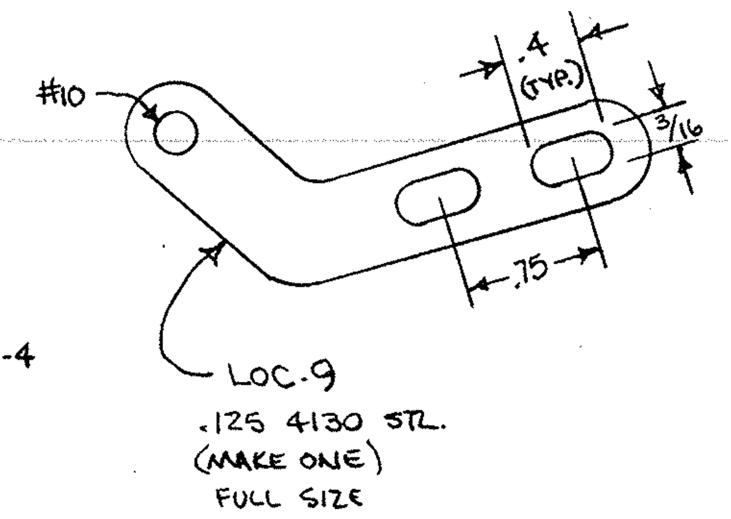


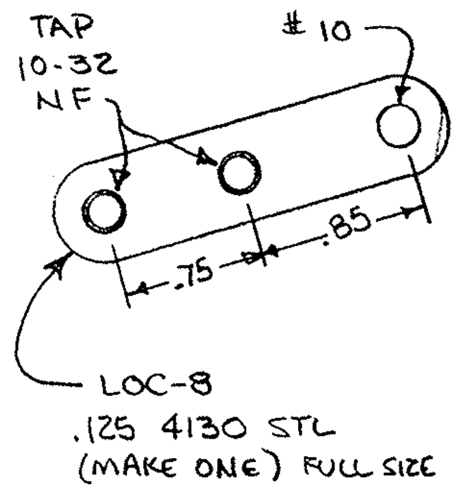


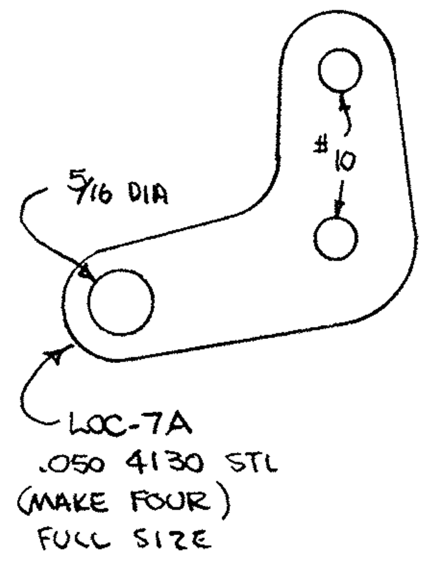


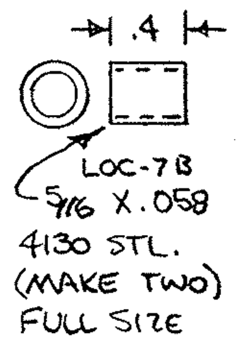


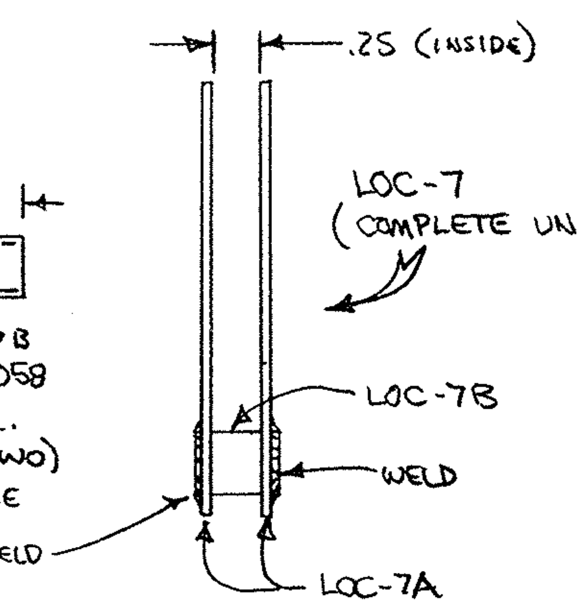


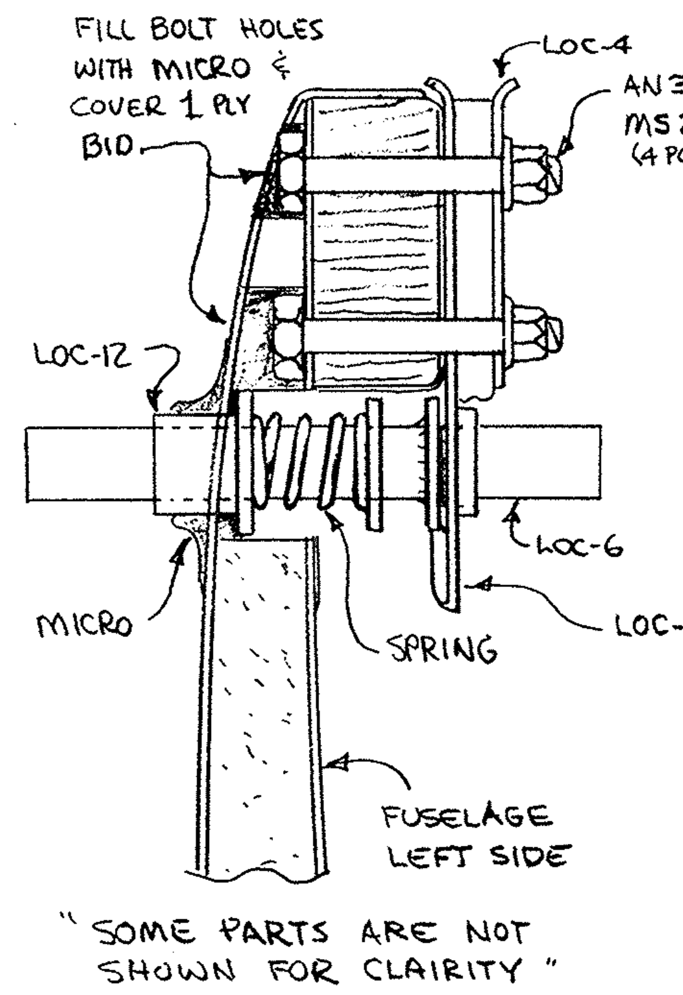




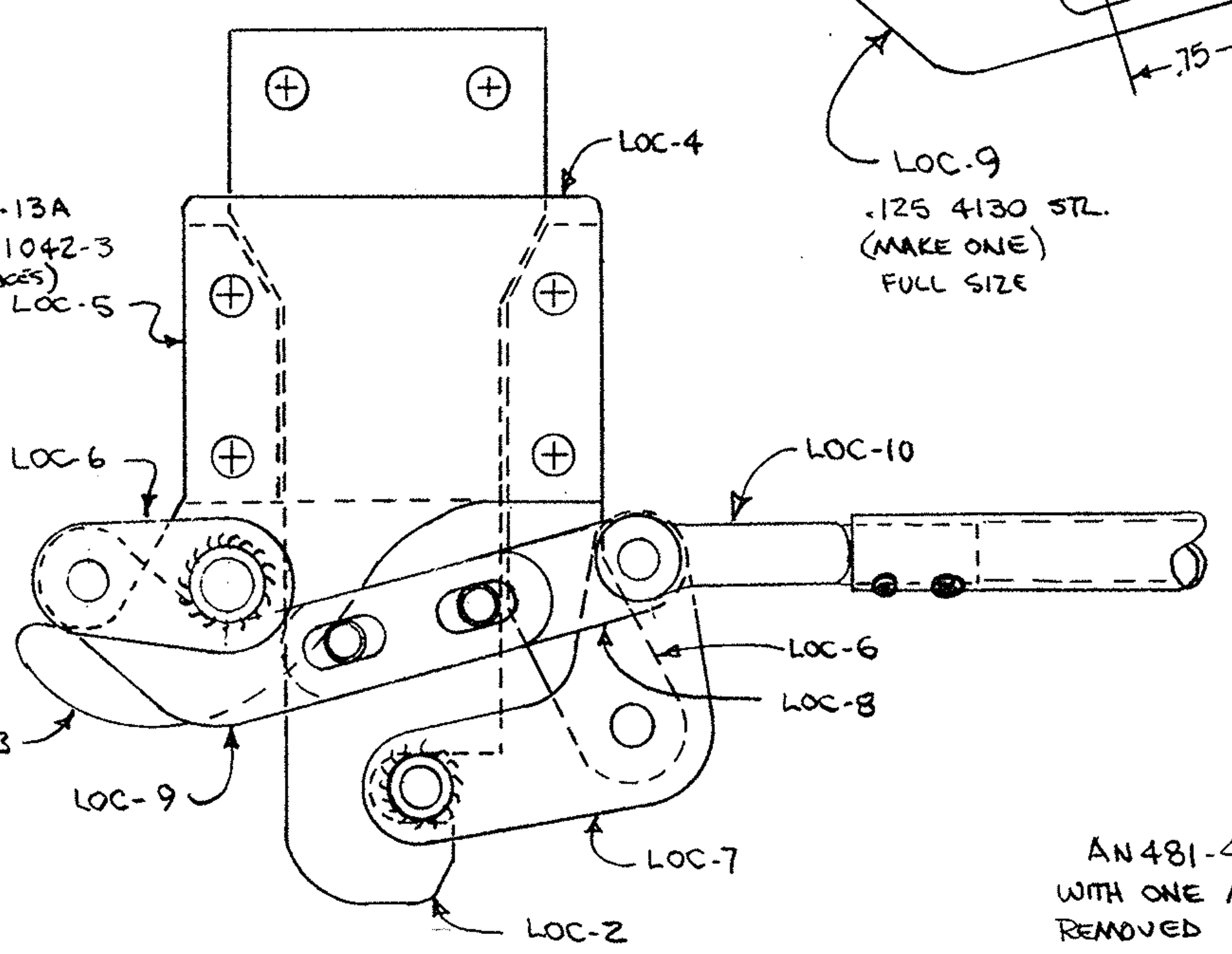




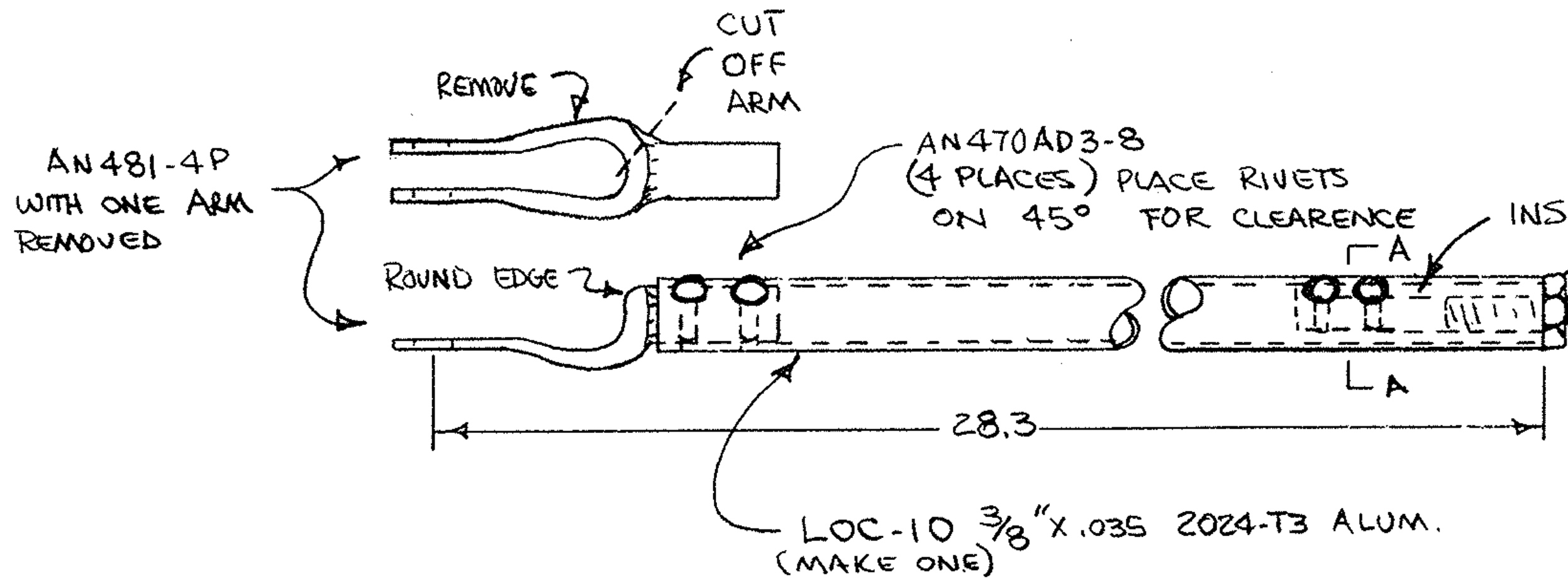


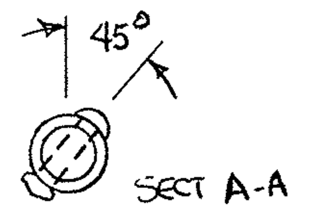


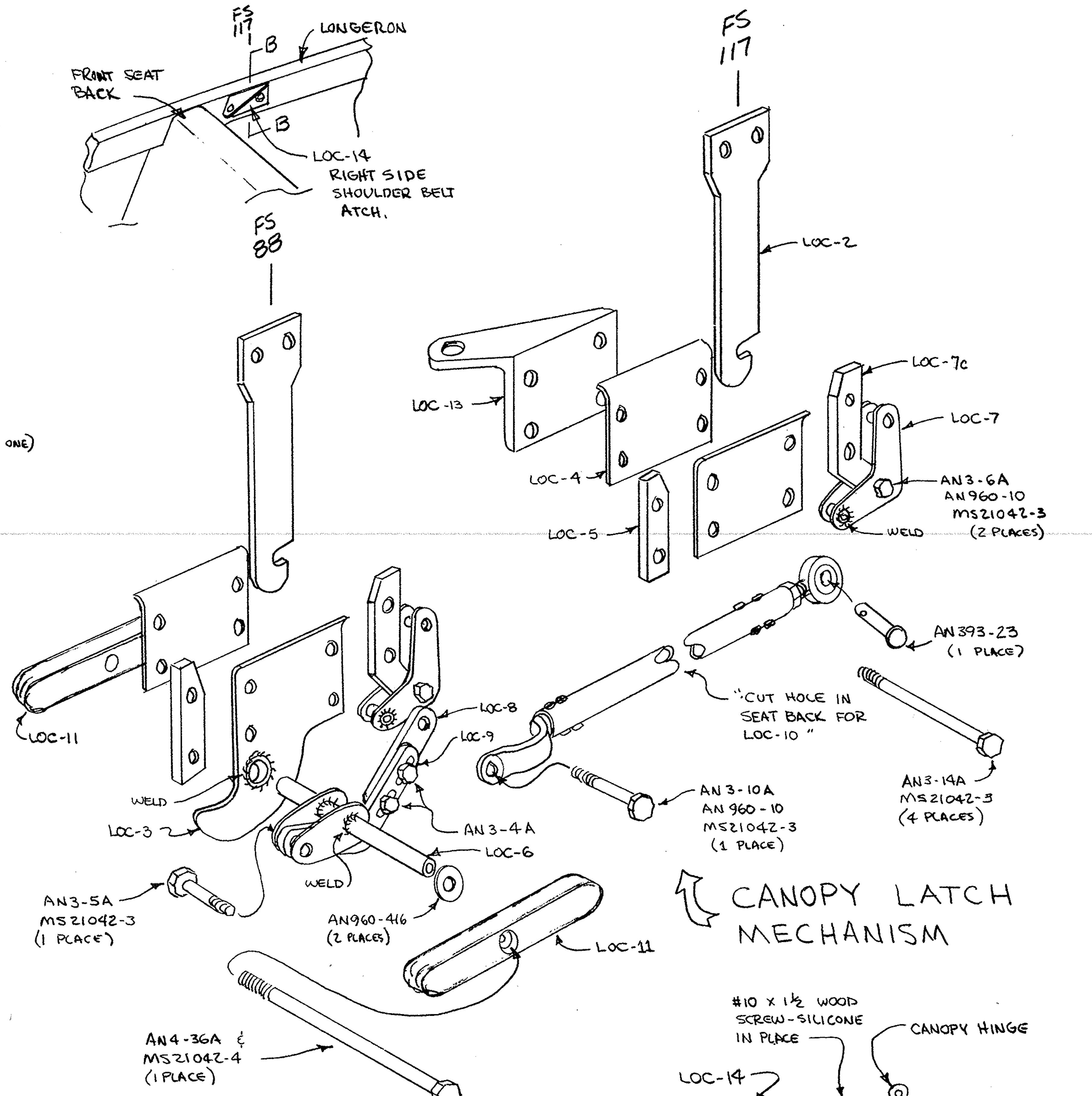
"SOME PARTS ARE NOT SHOWN FOR CLAIRITY"



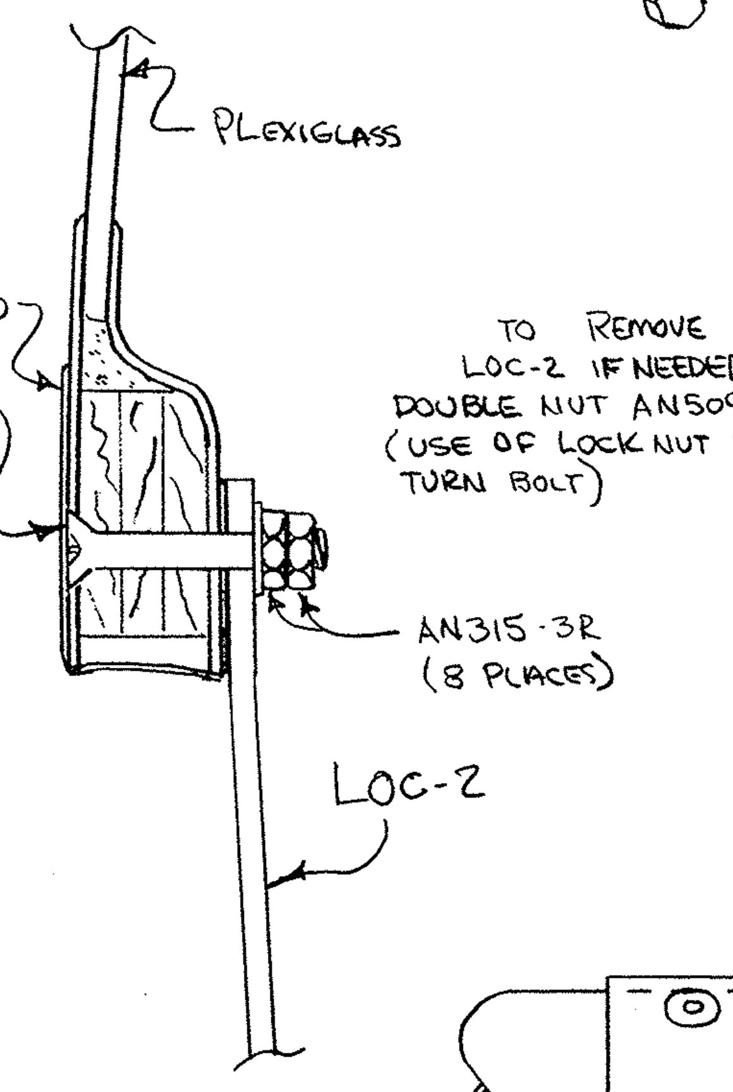
PARTS LOC-3
LOC-6
LOC-8
& LOC-9
ARE NOT REQ'D
ON AFT LOCK MECH.-
LOC-3 IS REPLACED
WITH ADD'L. LOC-4

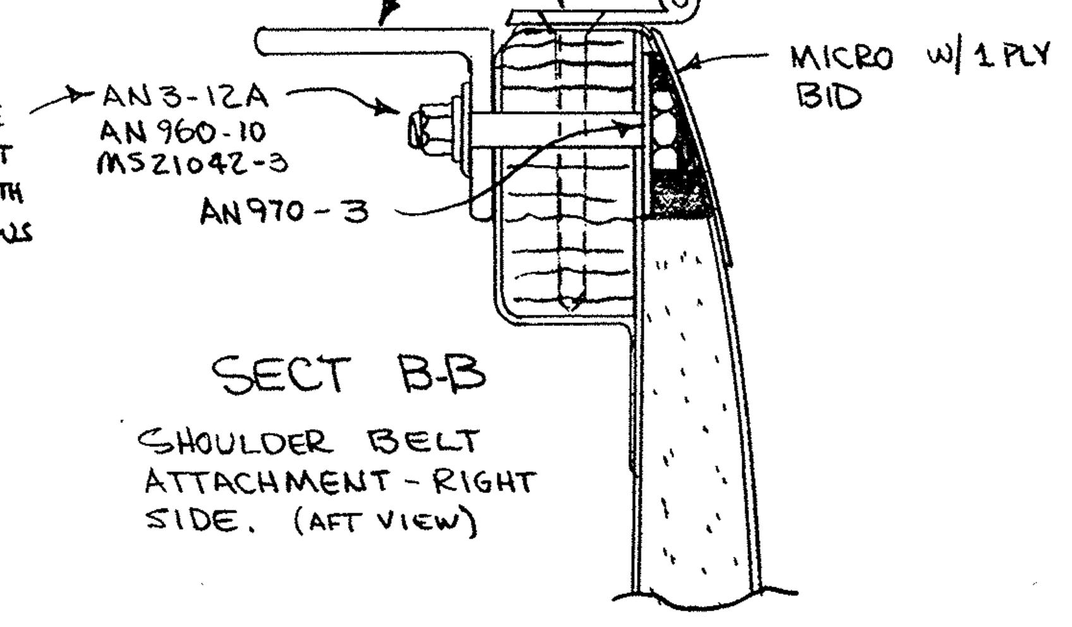






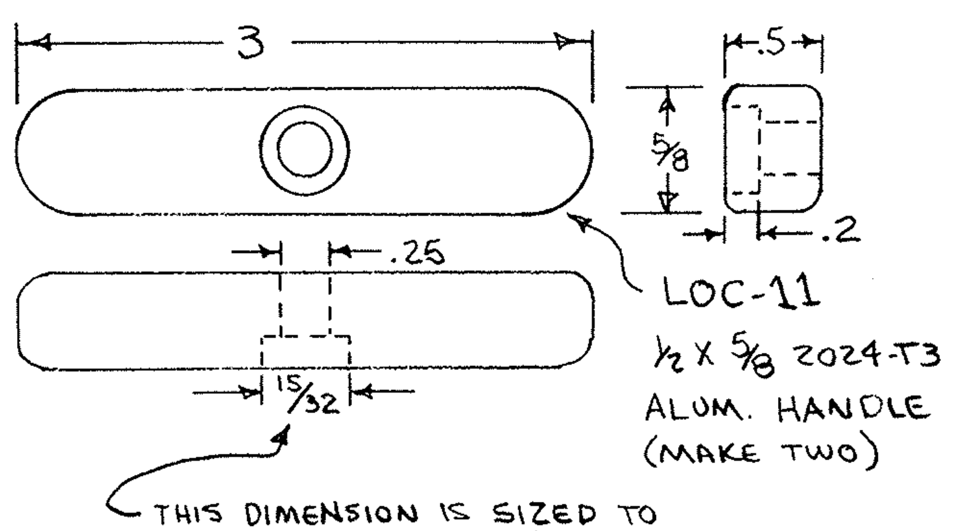
CANOPY LATCH MECHANISM



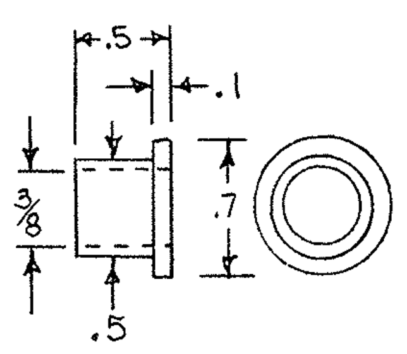


SECT B-B

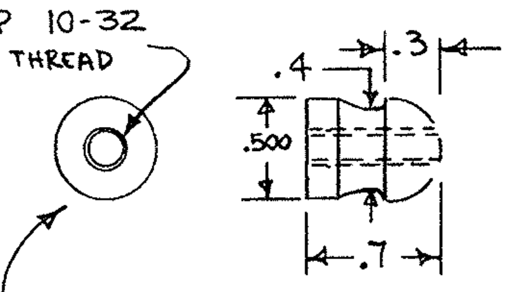
SHOULDER BELT ATTACHMENT - RIGHT SIDE. (AFT VIEW)



LOC-11
½ X ⅝ 2024-T3
ALUM. HANDLE
(MAKE TWO)



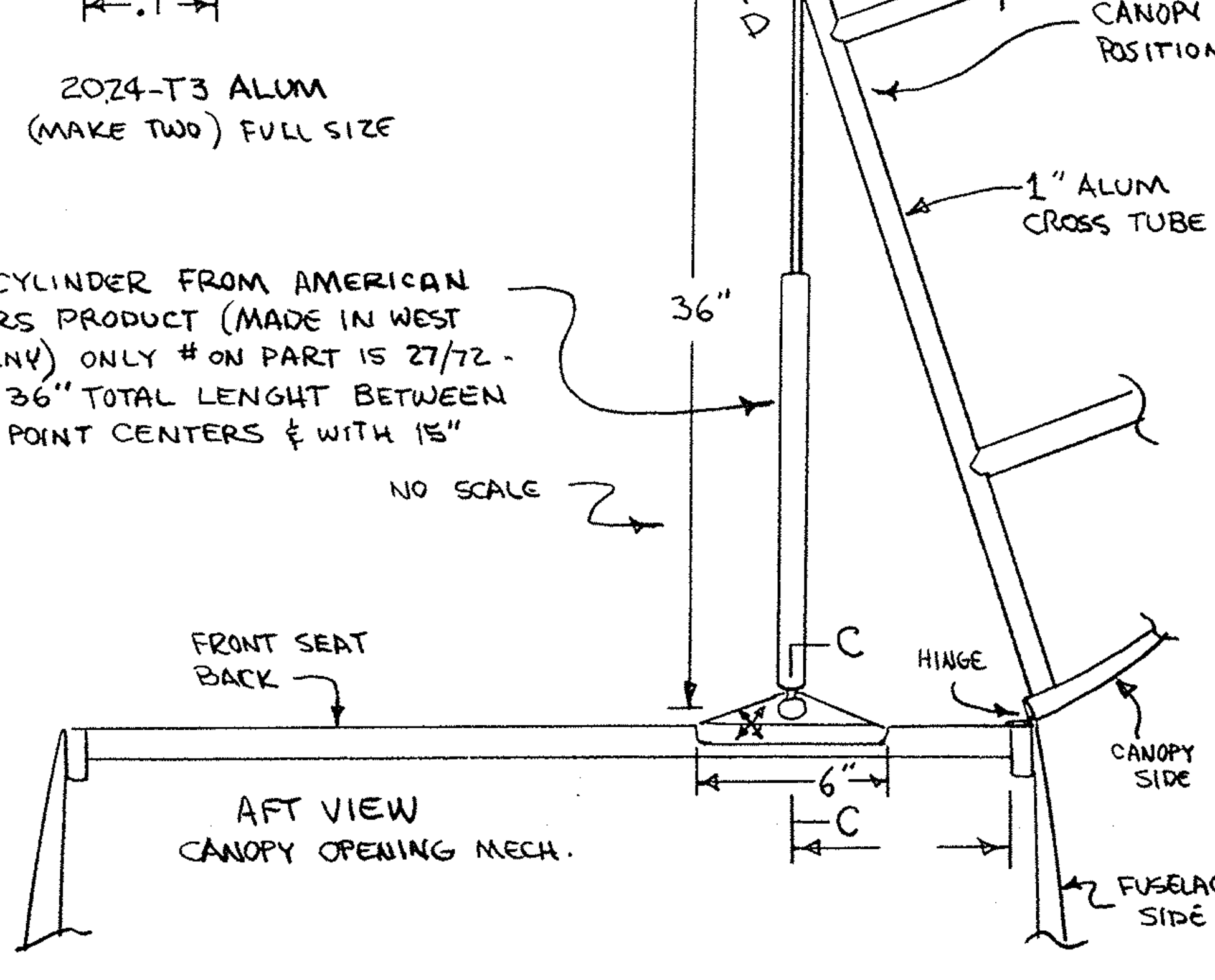
LOC-12
2024-T3 ALUM
(MAKE ONE)
FULL SIZE



LOC-15 2024-T3 ALUM
(MAKE TWO) FULL SIZE

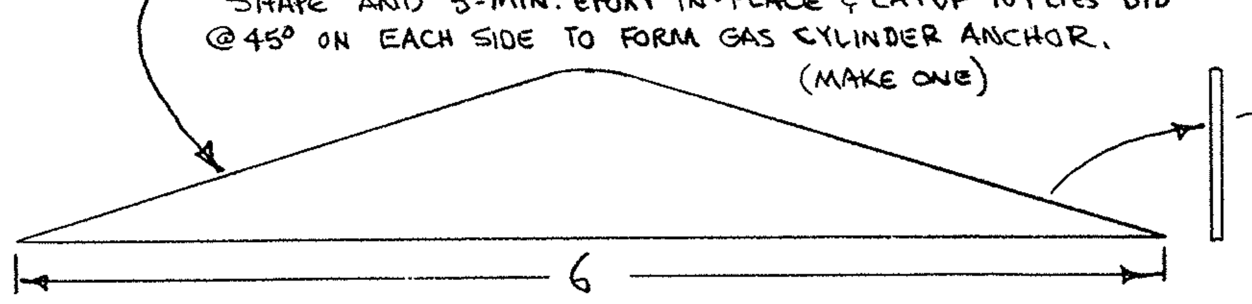
GAS CYLINDER FROM AMERICAN MOTORS PRODUCT (MADE IN WEST GERMANY) ONLY # ON PART IS 27/72 - HAS 36" TOTAL LENGHT BETWEEN ATCH POINT CENTERS & WITH 15" RAM

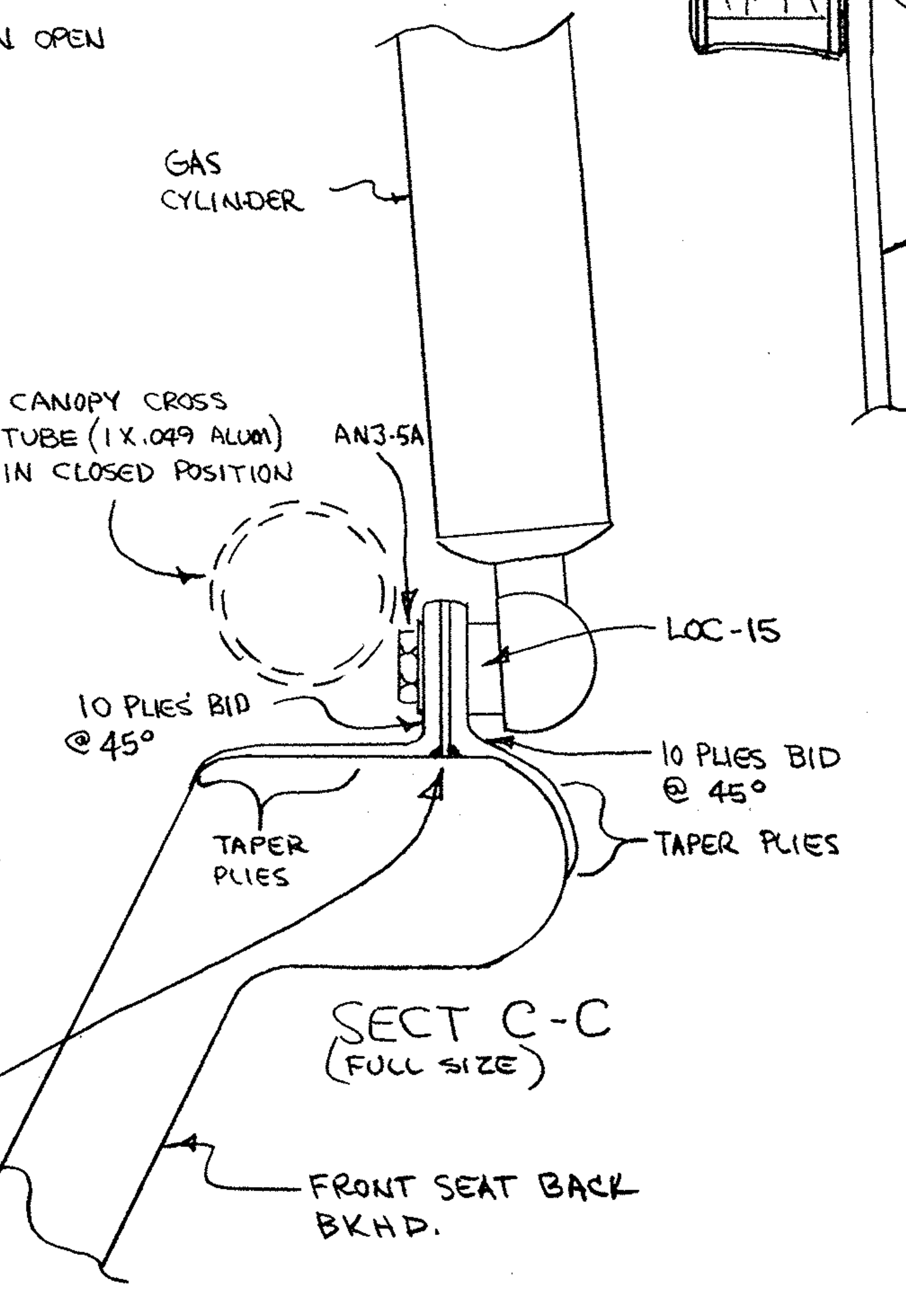
NO SCALE



AFT VIEW
CANOPY OPENING MECH.

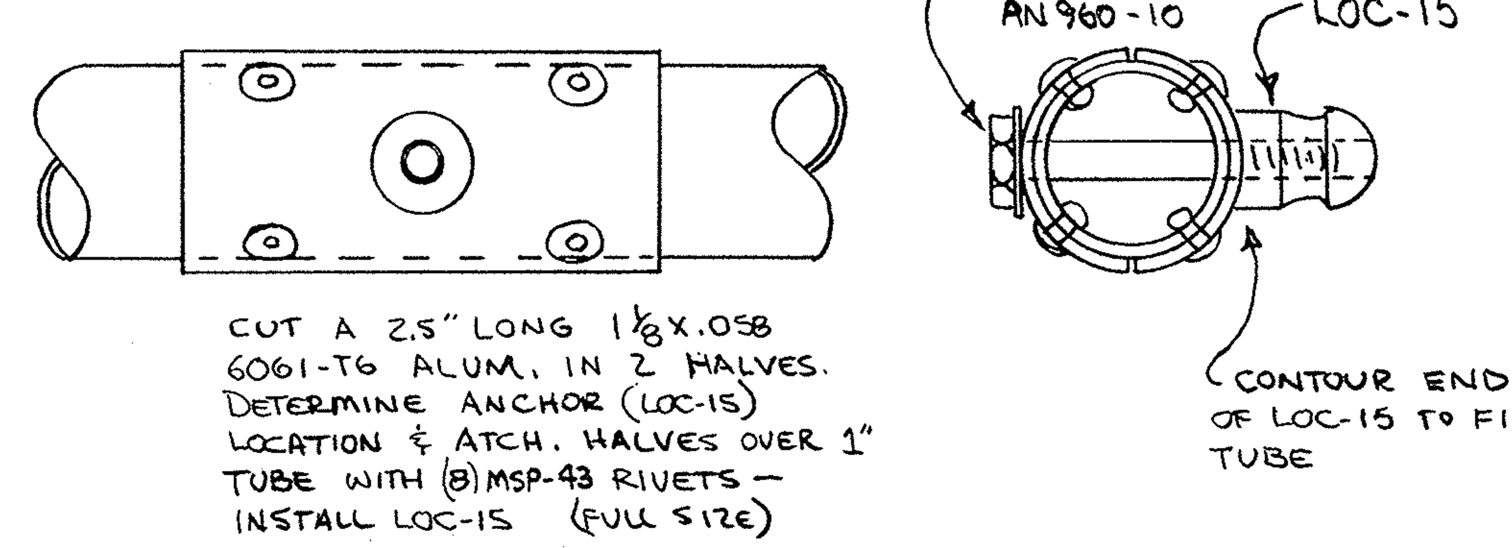
2 TO 4 PLIES BID (PRE-CURED) - CUT TO THIS SHAPE AND 5-MIN. EPOXY IN-PLACE & LAYUP 10 PLIES BID @45° ON EACH SIDE TO FORM GAS CYLINDER ANCHOR.
(MAKE ONE)



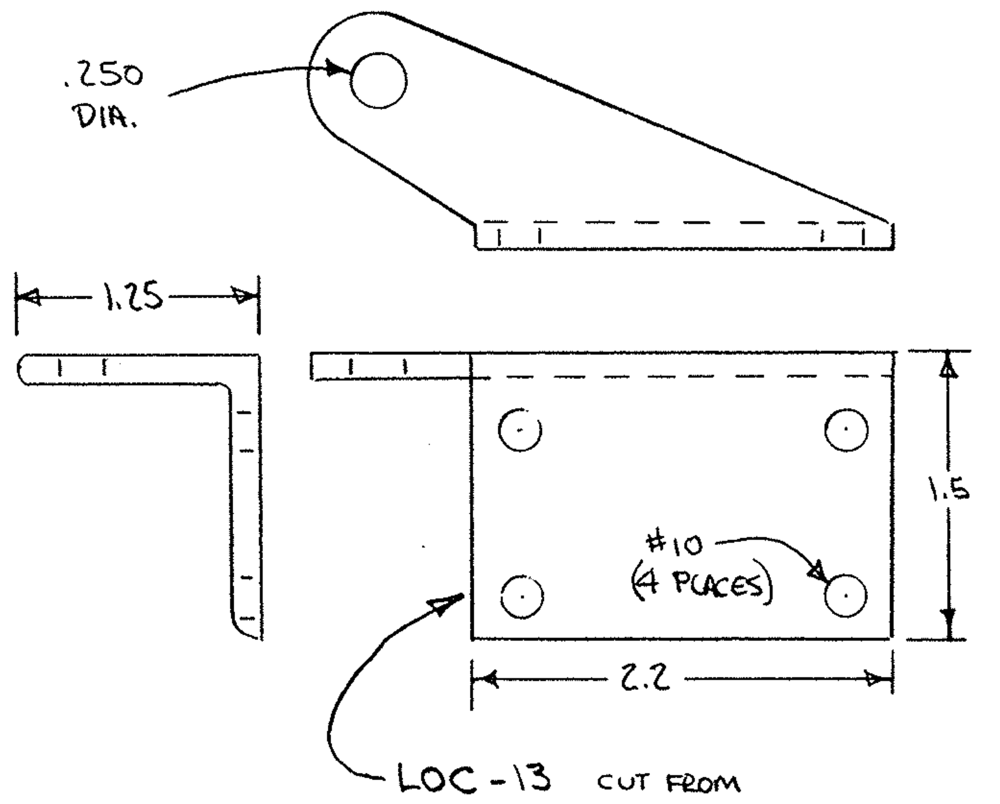


SECT C-C
(FULL SIZE)

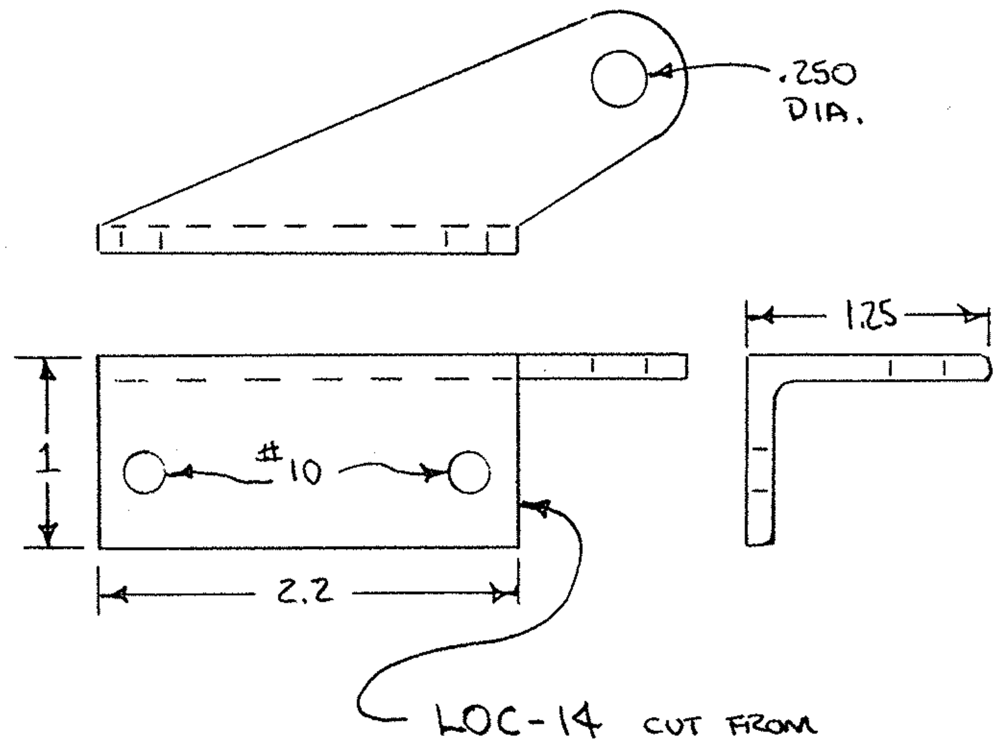
SECT D-D



CUT A 2.5" LONG 1⅛X.058 6061-T6 ALUM. IN 2 HALVES. DETERMINE ANCHOR (LOC-15) LOCATION & ATCH. HALVES OVER 1" TUBE WITH (8) MSP-43 RIVETS - INSTALL LOC-15 (FULL SIZE)

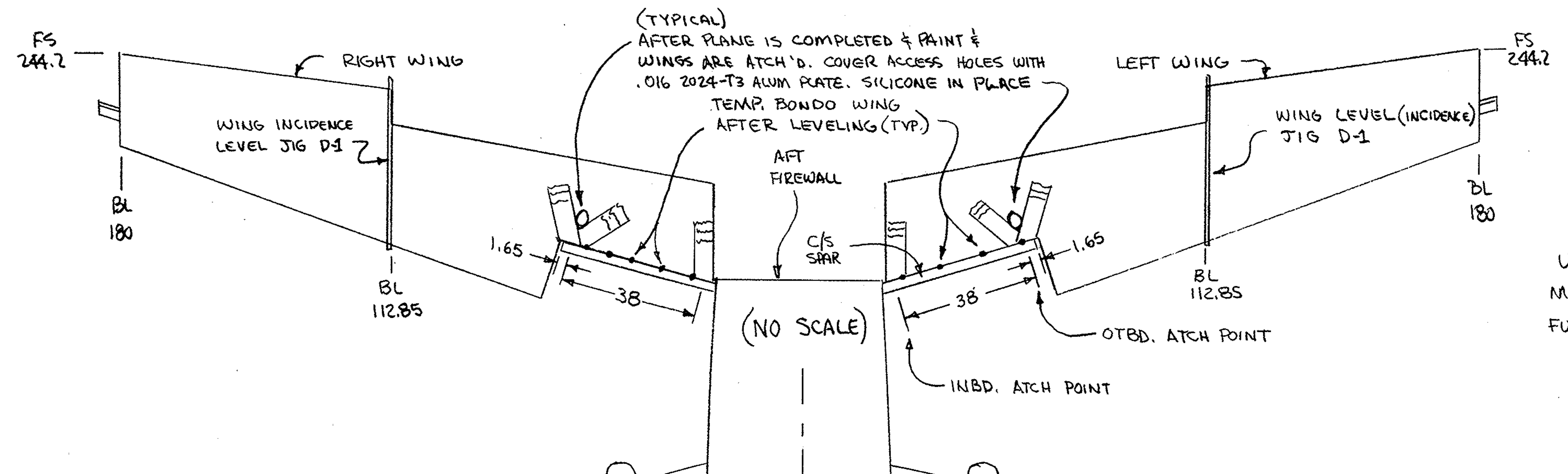


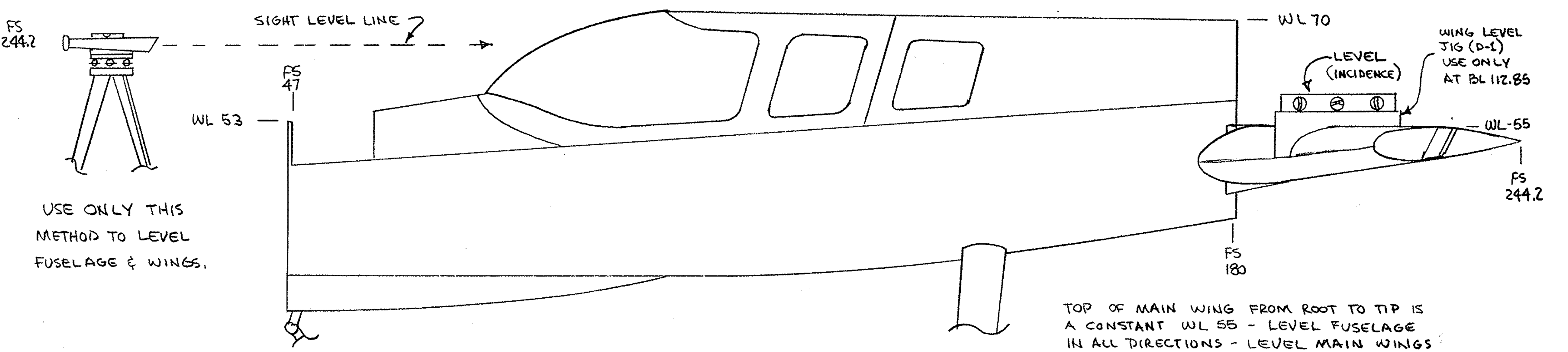
LOC-13 CUT FROM
.125 X 1.5 X 1.5 EXTRUDED
ALUM. (MAKE ONE)
FULL SIZE
"SHOULDER STRAP ATCH."
LEFT SIDE



LOC-14 CUT FROM
.125 X 1.5 X 1.5 EXTRUDED ALUM.
(MAKE ONE) FULL SIZE
"SHOULDER STRAP ATCH. RIGHT SIDE"

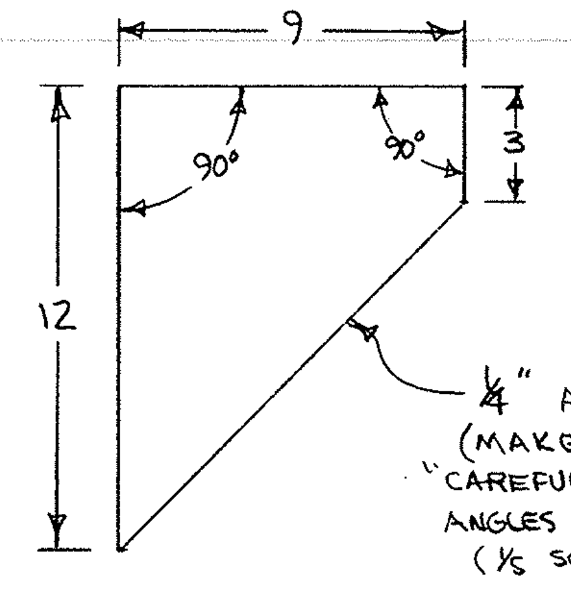
IMPORTANT – DRILL ALL WING ATCH. HOLES (INCLUDING ¼" FITTING HOLES) BEFORE BUILDING MAIN FUEL TANKS!


FS 244.2
RIGHT WING
WING INCIDENCE LEVEL JIG D-1
BL 180
BL 112.85
(TYPICAL) AFTER PLANE IS COMPLETED & PAINT & WINGS ARE ATCH'D. COVER ACCESS HOLES WITH .016 2024-T3 ALUM PLATE. SILICONE IN PLACE
TEMP. BONDO WING AFTER LEVELING (TYP.)
AFT FIREWALL
C/S SPAR
1.65
38
(NO SCALE)
LEFT WING
WING LEVEL (INCIDENCE) JIG D-1
FS 244.2
BL 180
BL 112.85
1.65
38
OTBD. ATCH POINT
INBD. ATCH POINT
BL '0'

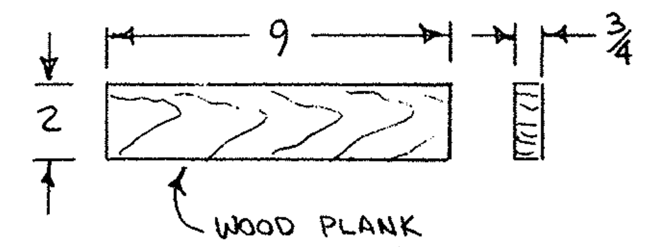


USE ONLY THIS METHOD TO LEVEL FUSELAGE & WINGS.

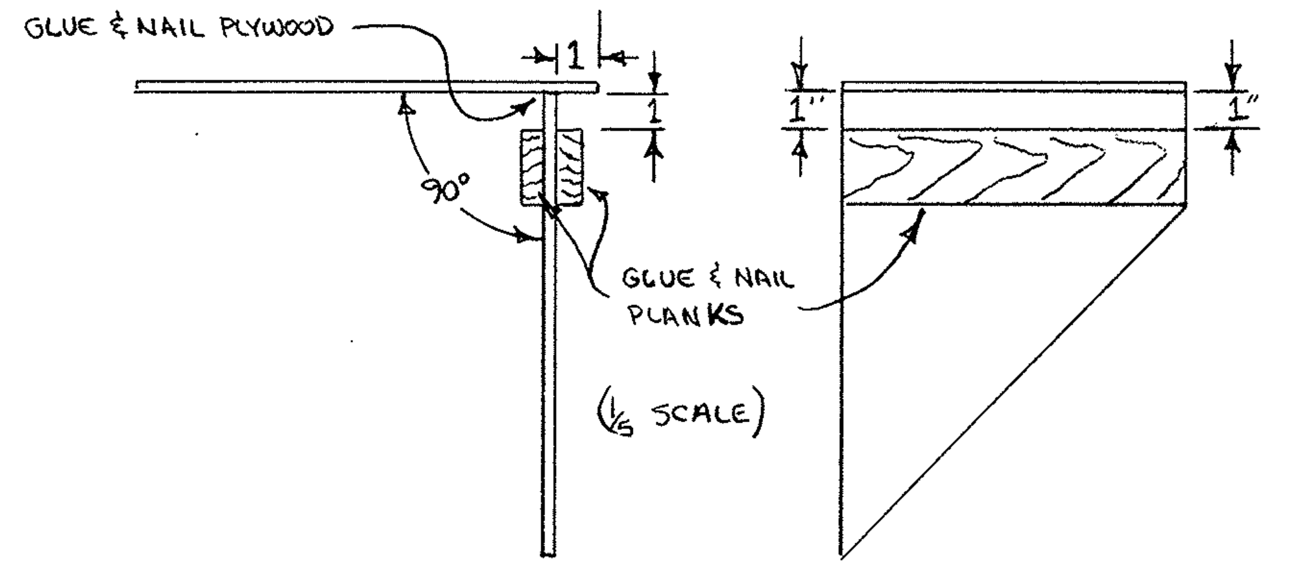
TOP OF MAIN WING FROM ROOT TO TIP IS A CONSTANT WL 55 – LEVEL FUSELAGE IN ALL DIRECTIONS – LEVEL MAIN WINGS BOTH SPAN & INCIDENCE (USE JIG D-1 @ BL 112.85 ONLY) – AFTER LEVELING TEMPORARY BONDO WING TO CENTER SECTION SPAR AND SET UP JIG FOR DRILLING – USE PATTERNS A & B (D-29) FOR HOLE GUIDE. (NO SCALE)



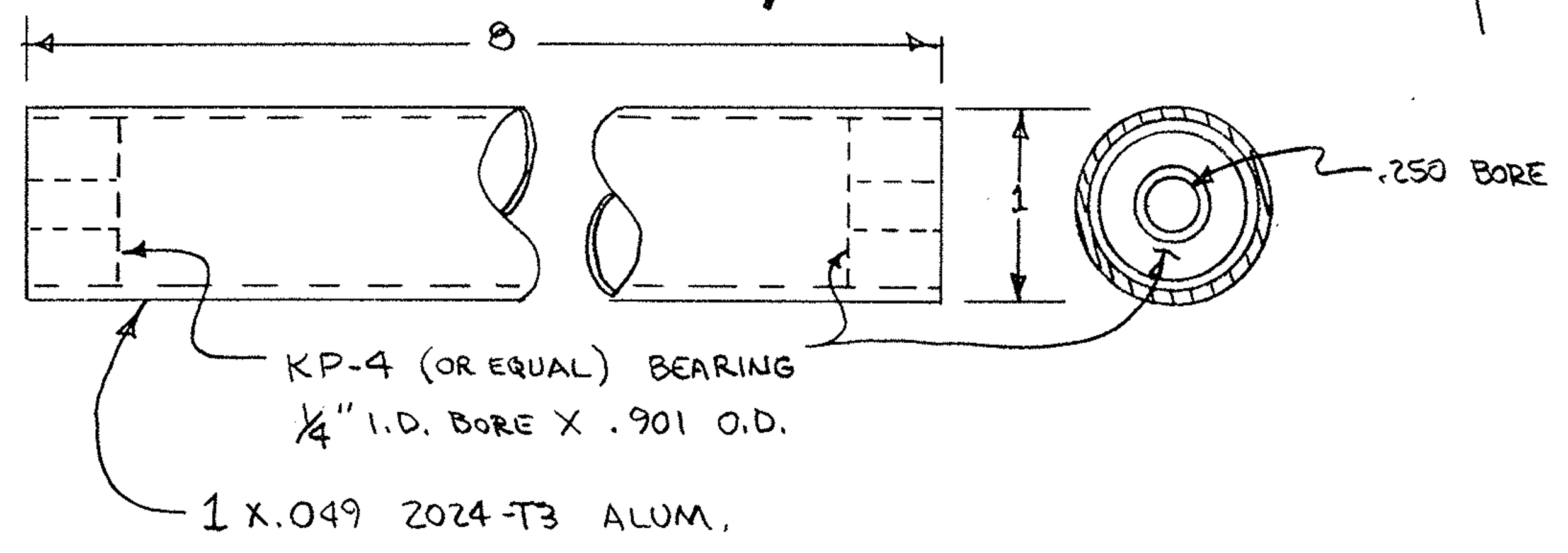
¼" AIRCRAFT PLYWOOD (MAKE TWO) "CAREFULLY MEASURE ANGLES & DIMENSION" (⅕ SCALE)



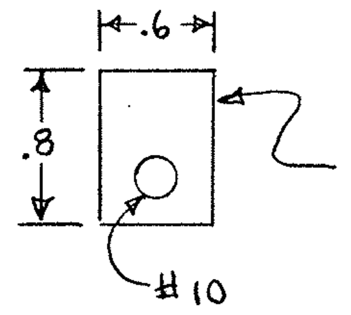
WOOD PLANK (MAKE TWO)



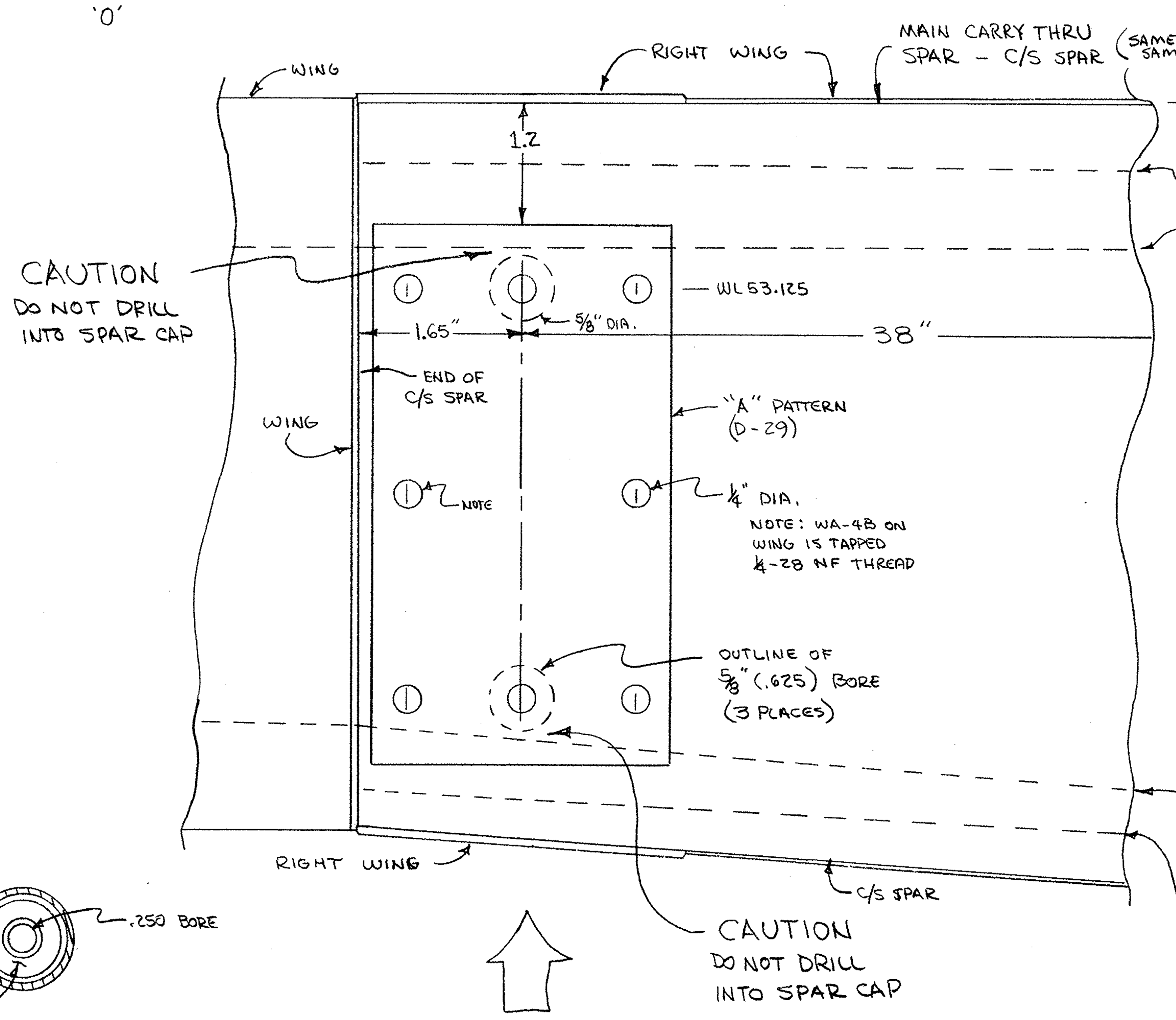
ALIGNMENT JIG – DRILL BIT GUIDE



"EPOXY BEARINGS IN PLACE OR DIMPLE ALUM. TUBE TO RETAIN"

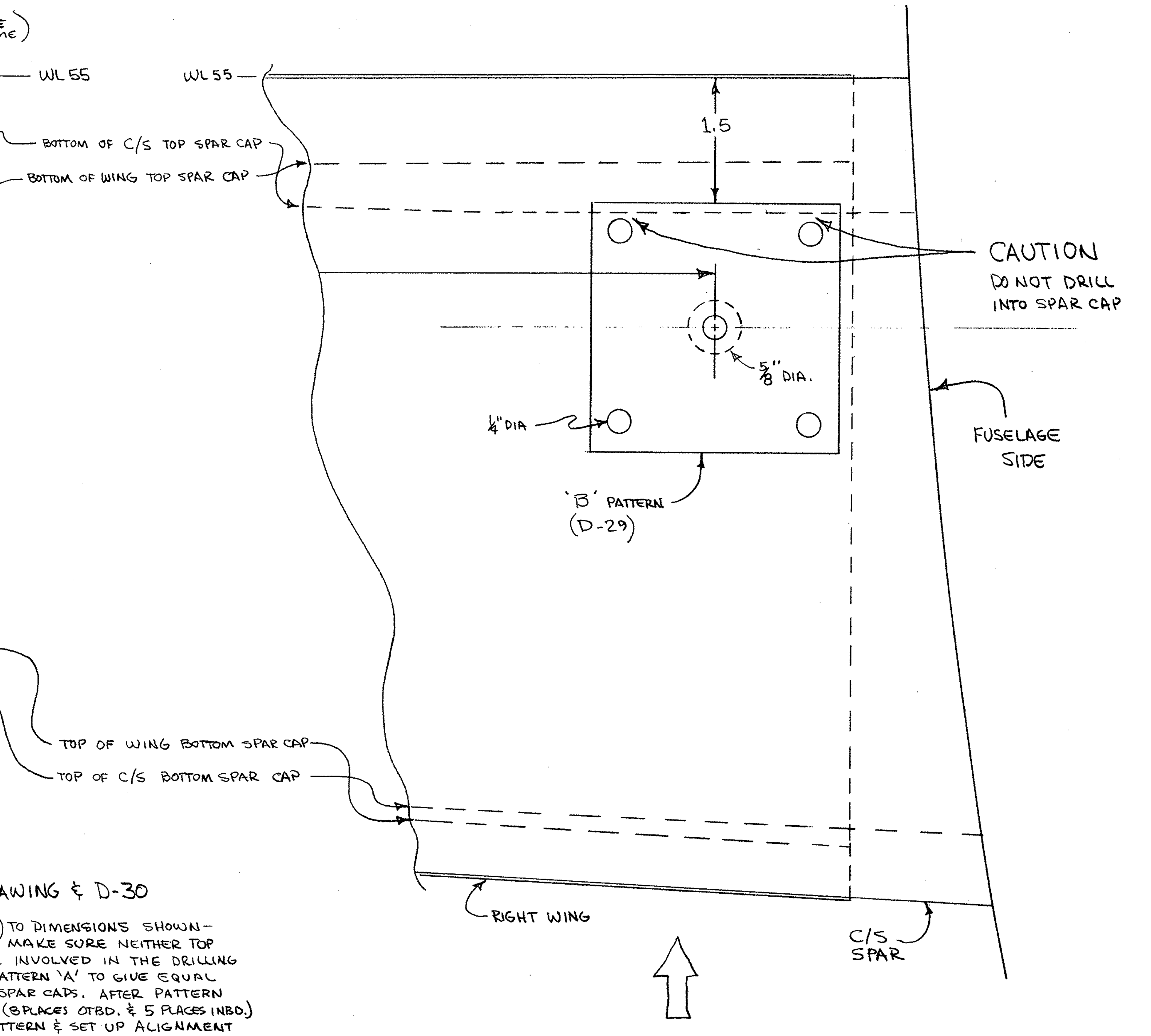


LOCK TAB TO HOLD DRILL GUIDE .063 MIN. 2024-T3 ALUM. (MAKE 6) (USE WOOD SCREW TO HOLD IN PLACE)


WING
RIGHT WING
MAIN CARRY THRU SPAR – C/S SPAR (SAME SAME)
WL 55
1.2
CAUTION DO NOT DRILL INTO SPAR CAP
WL 53.125
⅝" DIA.
1.65"
38"
END OF C/S SPAR
WING
"A" PATTERN (D-29)
NOTE
¼" DIA. NOTE: WA-4B ON WING IS TAPPED ¼-28 NF THREAD
OUTLINE OF ⅝" (.625) BORE (3 PLACES)
RIGHT WING
C/S SPAR
CAUTION DO NOT DRILL INTO SPAR CAP

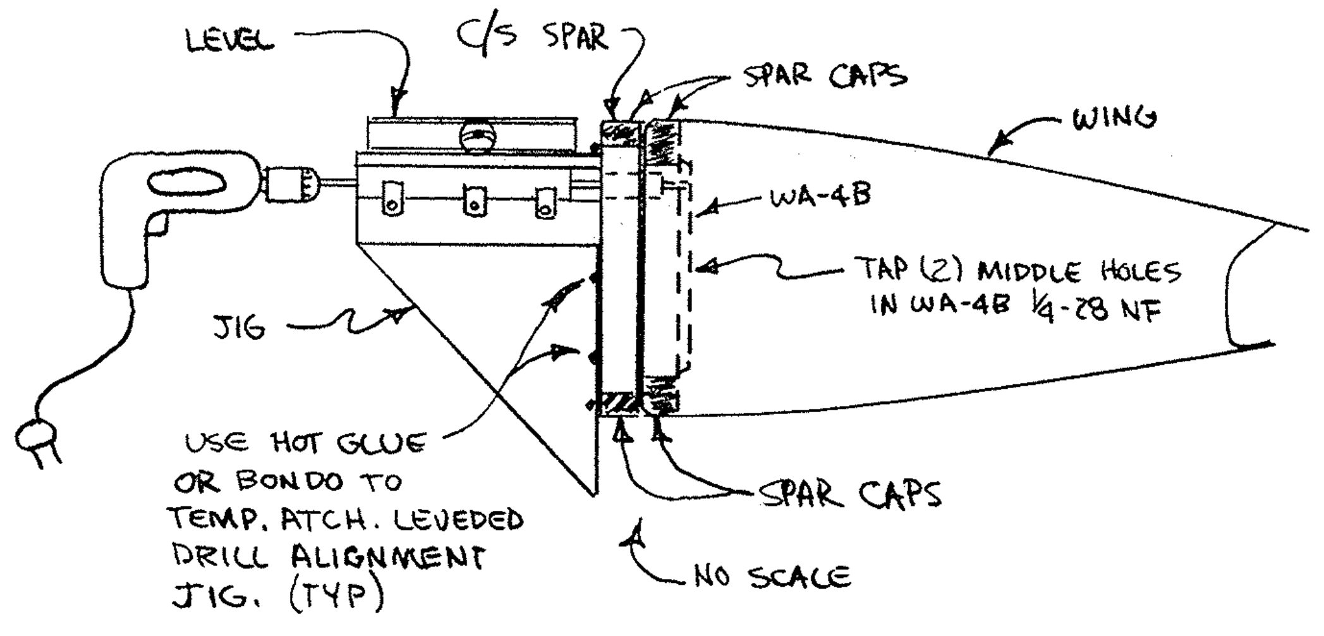
OUTBOARD ATCH. RIGHT WING

FRONT VIEW (FULL SIZE)


WL 55
BOTTOM OF C/S TOP SPAR CAP
BOTTOM OF WING TOP SPAR CAP
WL 55
1.5
CAUTION DO NOT DRILL INTO SPAR CAP
⅝" DIA.
¼" DIA
'B' PATTERN (D-29)
FUSELAGE SIDE
TOP OF WING BOTTOM SPAR CAP
TOP OF C/S BOTTOM SPAR CAP
RIGHT WING
C/S SPAR

INBOARD ATCH. RIGHT WING.

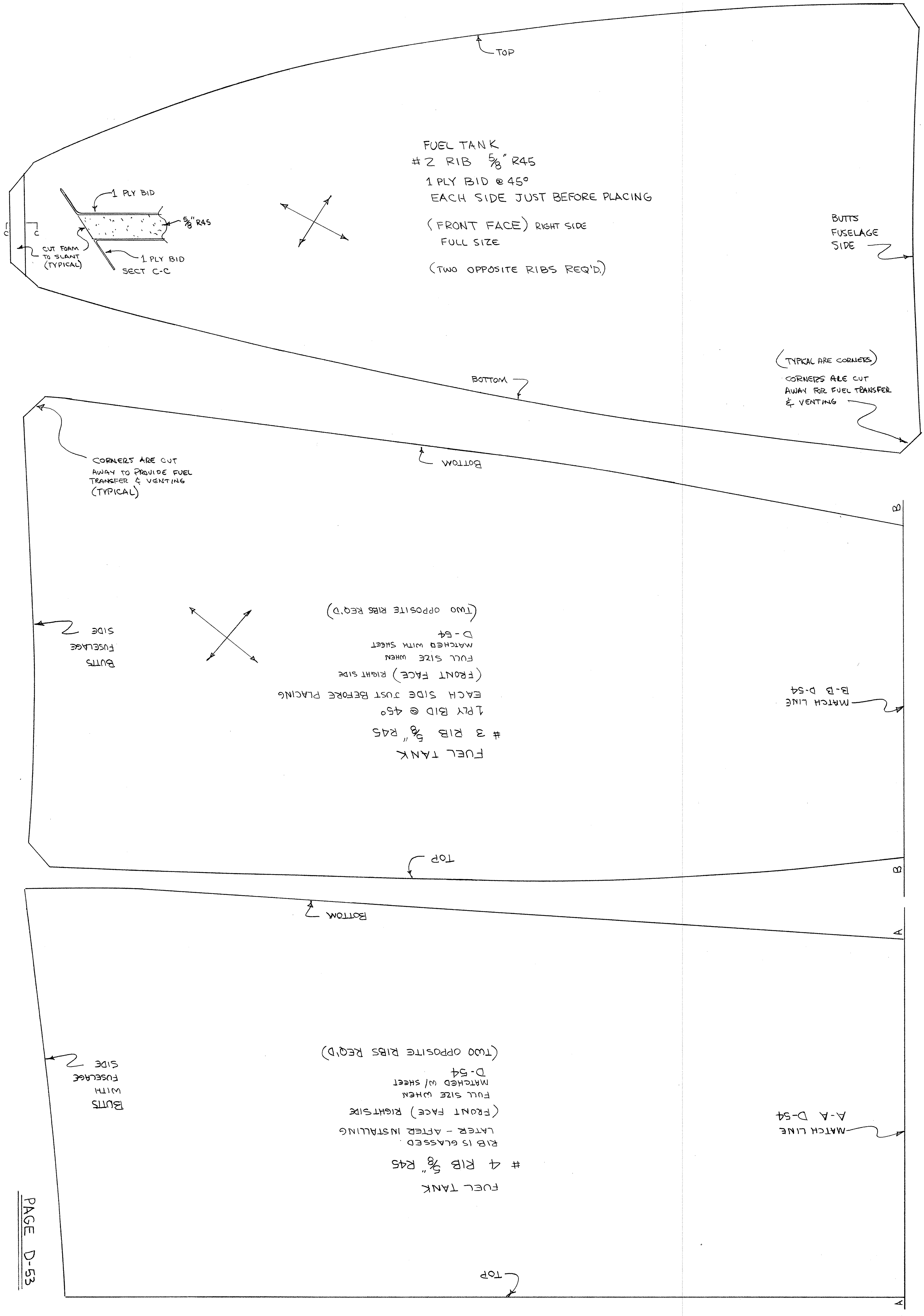
FRONT VIEW (FULL SIZE)

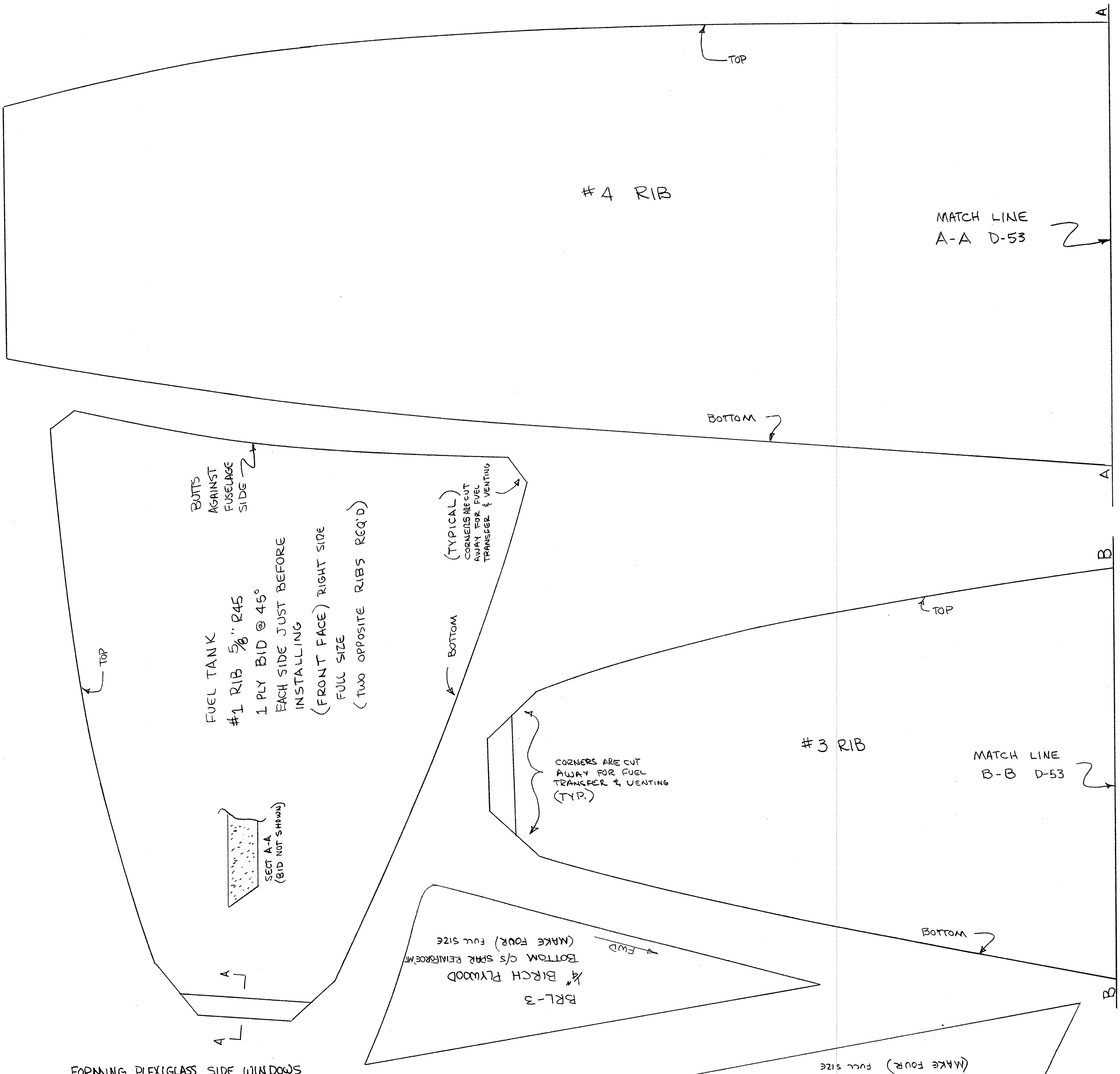

LEVEL
C/S SPAR
SPAR CAPS
WING
WA-4B
TAP (2) MIDDLE HOLES IN WA-4B ¼-28 NF
JIG
USE HOT GLUE OR BONDO TO TEMP. ATCH. LEVEDED DRILL ALIGNMENT JIG. (TYP)
SPAR CAPS
NO SCALE

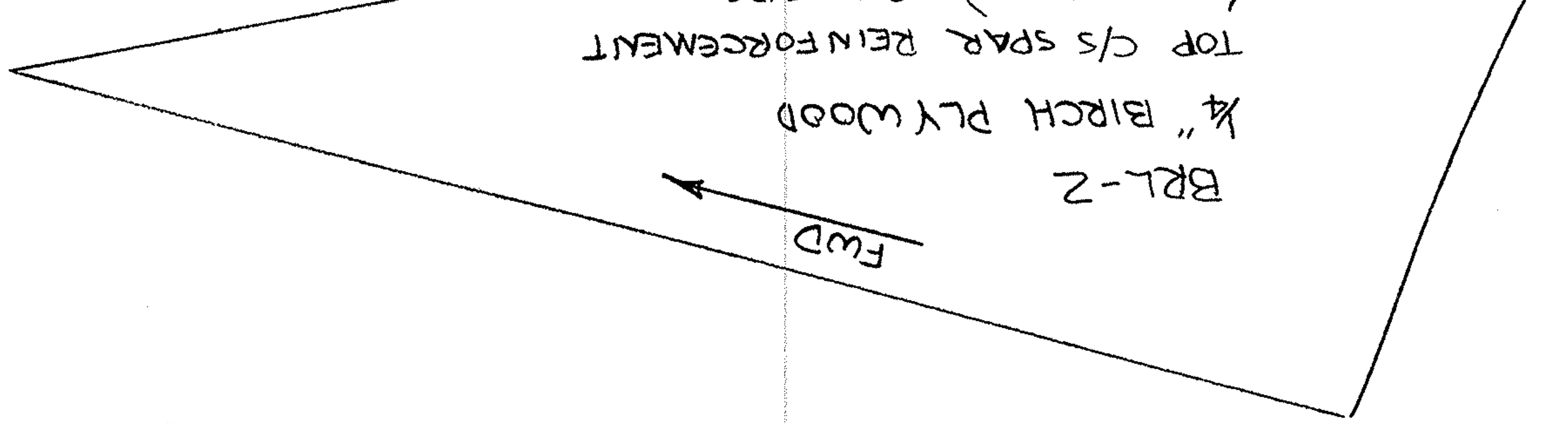
CAREFULLY STUDY THIS DRAWING & D-30

POSITION PATTERNS 'A' & 'B' (D-29) TO DIMENSIONS SHOWN – CAREFULLY CHECK ALIGNMENT TO MAKE SURE NEITHER TOP OR BOTTOM SPAR CAPS WILL BE INVOLVED IN THE DRILLING OR BORING PROCESS. ADJUST PATTERN 'A' TO GIVE EQUAL CLEARENCE FROM TOP & BOTTOM SPAR CAPS. AFTER PATTERN IS ALIGNED DRILL EACH ¼" HOLE (8 PLACES OTBD. & 5 PLACES INBD.) ONLY ¼" TO ⅜" DEEP. REMOVE PATTERN & SET UP ALIGNMENT JIG TO FINISH DRILLING EACH ¼" CENTER ATCH. HOLE – DRILL THRU C/S SPAR & WING SPAR AT SAME TIME ON EACH ATCH. HOLE. AFTER DRILL ¼" HOLE REPLACE ¼" BIT WITH ⅝" SPOTFACE TO BORE OUT ⅝" HOLE THRU BOTH SPARS FOR WA-6 BUSHINGS. NOTE: THE TWO MIDDLE ¼" HOLES ON THE WING OTBD. FITTING ARE DRILLED ONLY DEEP ENOUGH TO INCOUNTER WA-4B. CHANGE BIT TO # 3 SIZE & AFTER DRILLING THREAD WA-4B (2 PLACES) WITH ¼-28 NF THREAD.

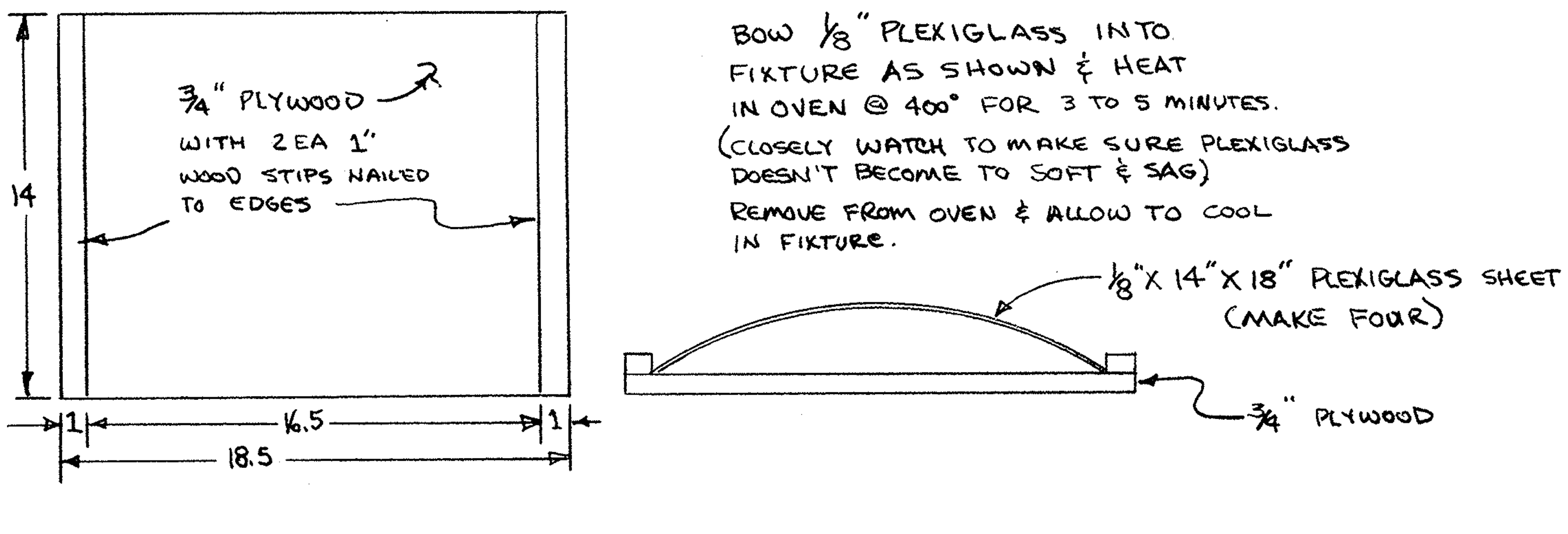
DO NOT PLACE WA-3, WA-3A, WA-4, & WA-4A ON CENTER SECTION SPAR UNTIL AFTER FUEL TANKS ARE BUILT AND ALL GLASSING IS COMPLETE.


TOP
FUEL TANK
#2 RIB 5/8" R45
1 PLY BID @ 45°
EACH SIDE JUST BEFORE PLACING
(FRONT FACE) RIGHT SIDE
FULL SIZE
(TWO OPPOSITE RIBS REQ'D.)
1 PLY BID
5/8" R45
1 PLY BID
SECT C-C
C
C
CUT FOAM TO SLANT (TYPICAL)
BUTTS FUSELAGE SIDE
(TYPICAL ARE CORNERS)
CORNERS ARE CUT AWAY FOR FUEL TRANSFER & VENTING
BOTTOM
CORNERS ARE CUT AWAY TO PROVIDE FUEL TRANSFER & VENTING (TYPICAL)
BOTTOM
B
FUEL TANK
# 3 RIB 5/8" R45
1 PLY BID @ 45°
EACH SIDE JUST BEFORE PLACING
(FRONT FACE) RIGHT SIDE
FULL SIZE WHEN MATCHED WITH SHEET D-54
(TWO OPPOSITE RIBS REQ'D)
BUTTS FUSELAGE SIDE
MATCH LINE B-B D-54
TOP
B
BOTTOM
A
FUEL TANK
# 4 RIB 5/8" R45
RIB IS GLASSED LATER - AFTER INSTALLING
(FRONT FACE) RIGHTSIDE
FULL SIZE WHEN MATCHED W/ SHEET D-54
(TWO OPPOSITE RIBS REQ'D)
BUTTS WITH FUSELAGE SIDE
MATCH LINE A-A D-54
TOP
A





FORMING PLEXIGLASS SIDE WINDOWS

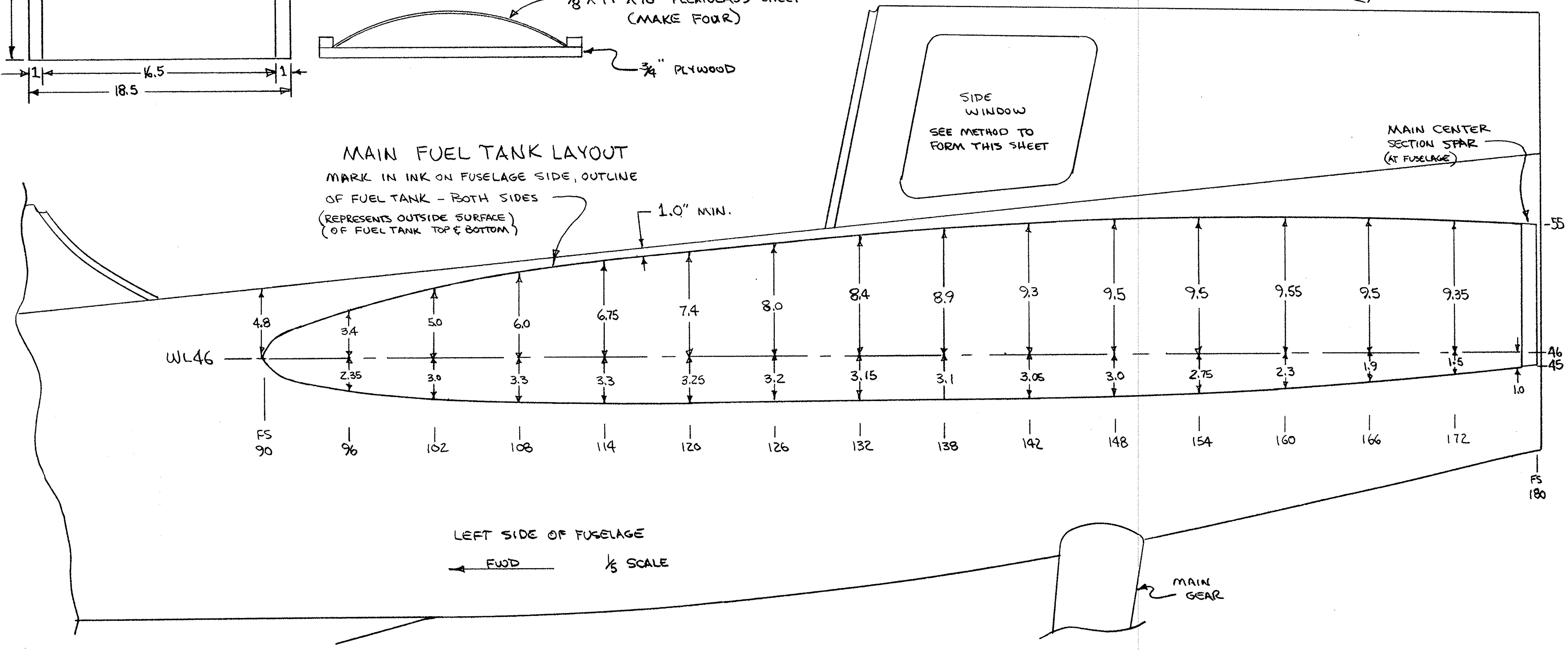


3/4" PLYWOOD
WITH 2 EA 1" WOOD STIPS NAILED TO EDGES
14
1
16.5
1
18.5
1/8" X 14" X 18" PLEXIGLASS SHEET (MAKE FOUR)
3/4" PLYWOOD

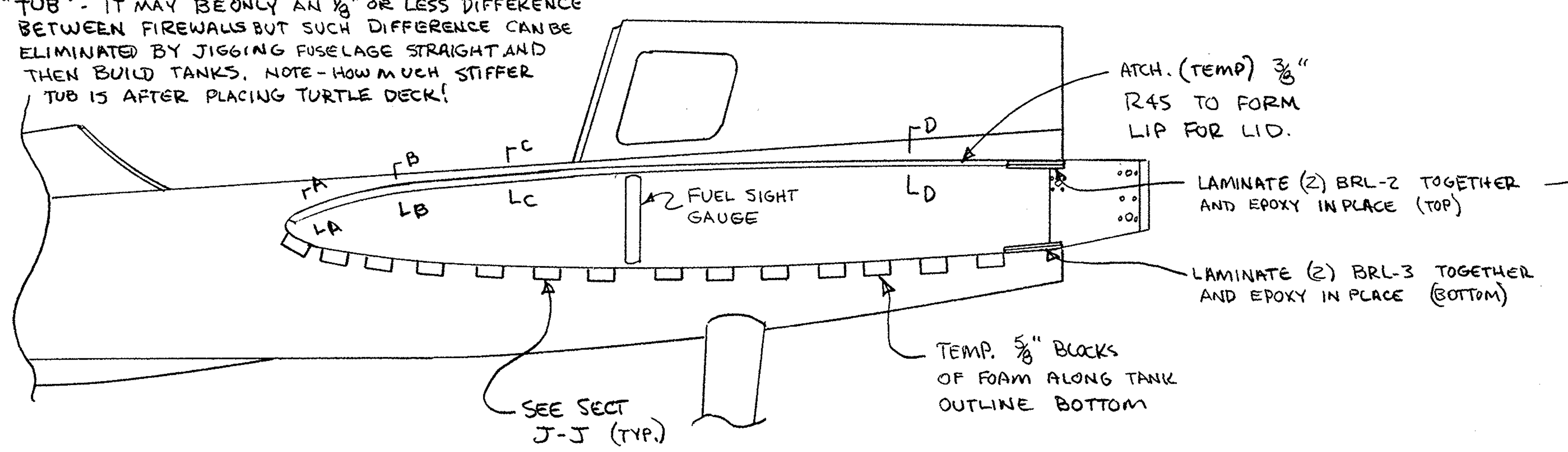
BOW 1/8" PLEXIGLASS INTO FIXTURE AS SHOWN & HEAT IN OVEN @ 400° FOR 3 TO 5 MINUTES. (CLOSELY WATCH TO MAKE SURE PLEXIGLASS DOESN'T BECOME TO SOFT & SAG) REMOVE FROM OVEN & ALLOW TO COOL IN FIXTURE.

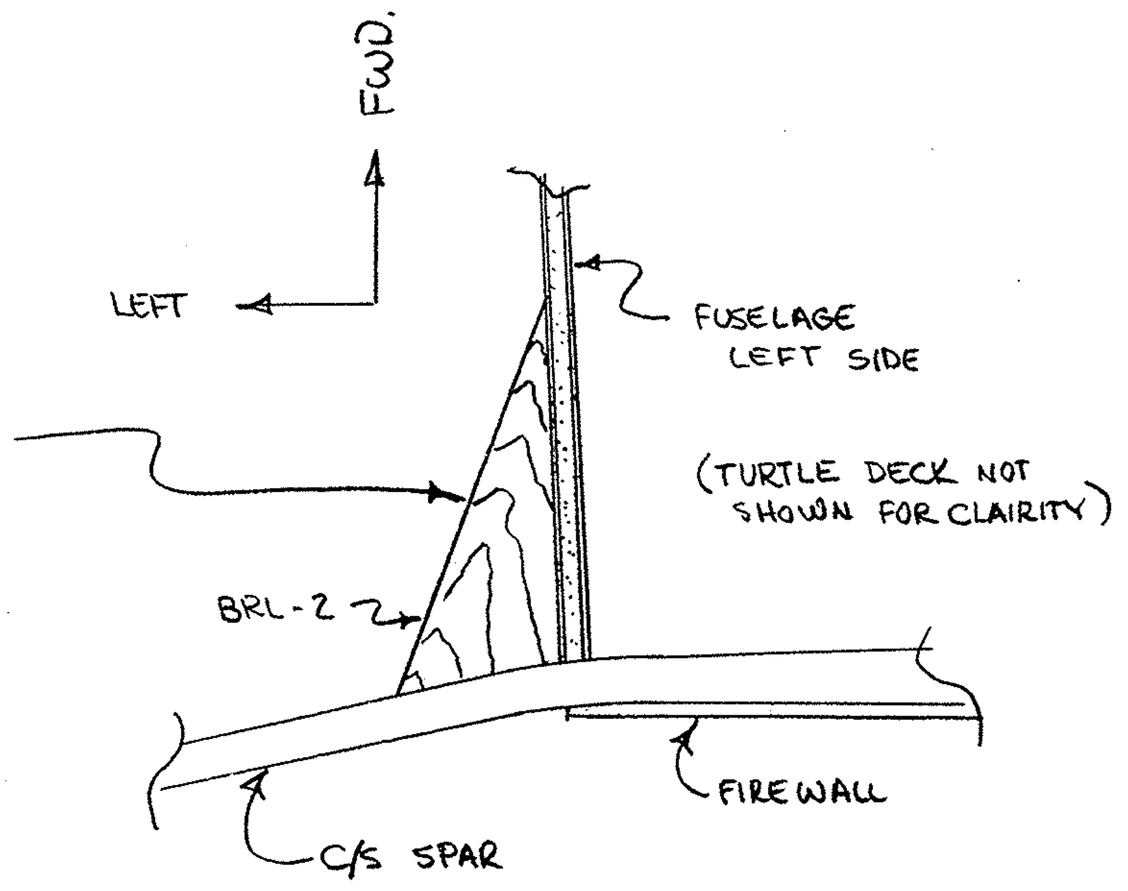
MAIN FUEL TANK LAYOUT

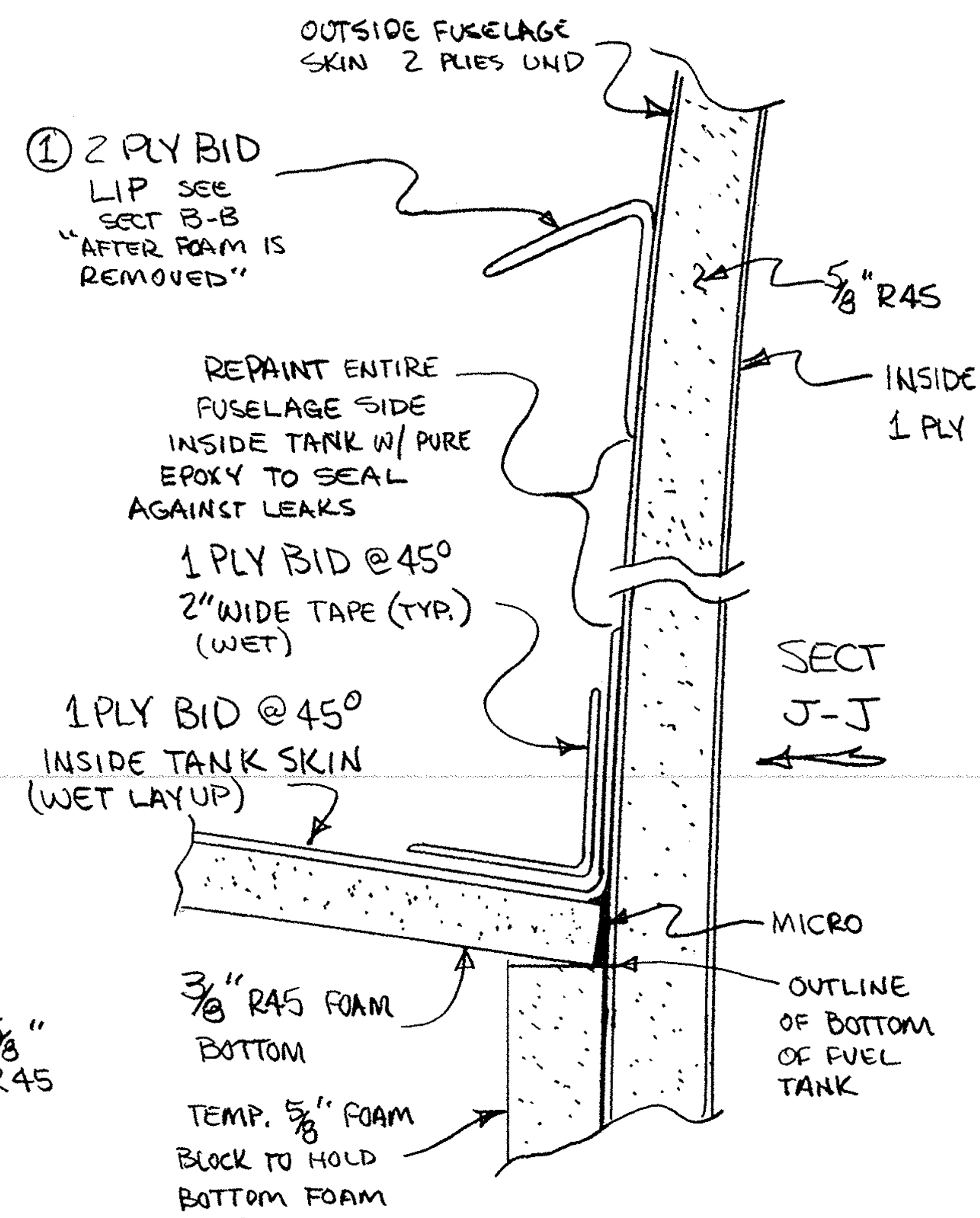
MARK IN INK ON FUSELAGE SIDE, OUTLINE OF FUEL TANK - BOTH SIDES (REPRESENTS OUTSIDE SURFACE OF FUEL TANK TOP & BOTTOM)



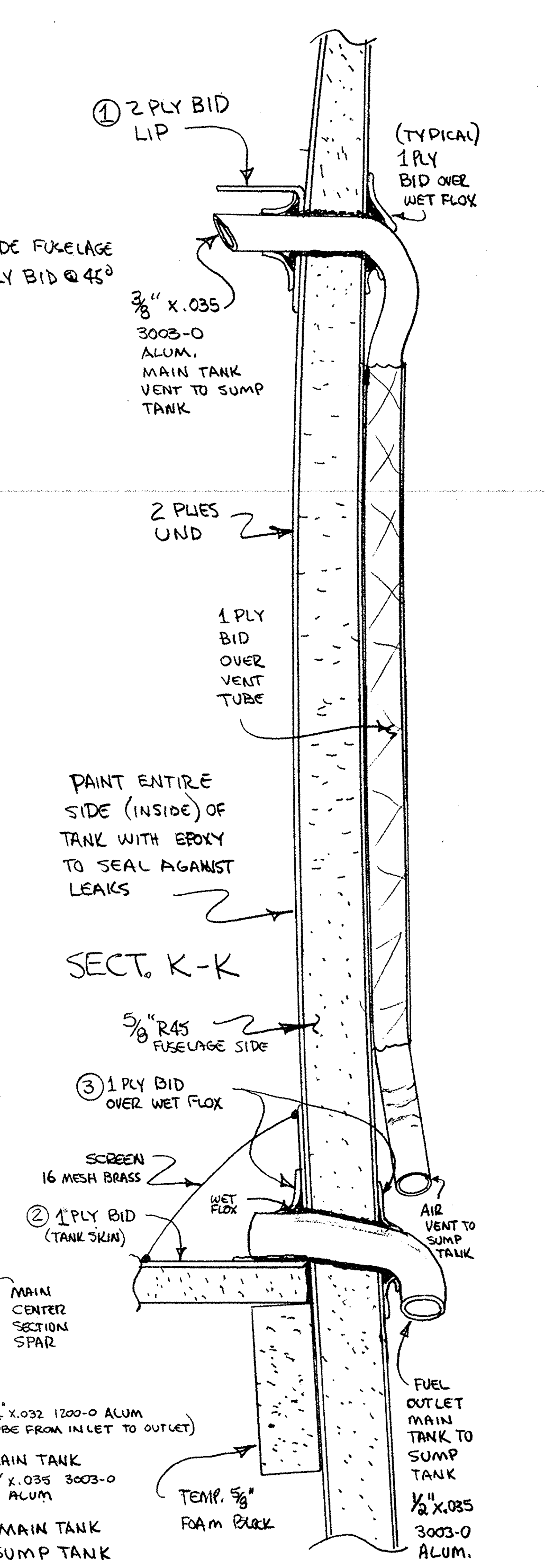
DURING CONST. OF MAIN FUEL TANKS CHECK ALIGNMENT (TWIST) OF FUSELAGE "TUB" - THIS WILL BE THE LAST STAGE OF CONST. TO AGAIN STRAIGHTEN "TUB". IT MAY BE ONLY AN 1/8" OR LESS DIFFERENCE BETWEEN FIREWALLS BUT SUCH DIFFERENCE CAN BE ELIMINATED BY JIGGING FUSELAGE STRAIGHT AND THEN BUILD TANKS. NOTE - HOW MUCH STIFFER TUB IS AFTER PLACING TURTLE DECK!


ATCH. (TEMP) 3/8" R45 TO FORM LIP FOR LID.
LAMINATE (2) BRL-2 TOGETHER AND EPOXY IN PLACE (TOP)
LAMINATE (2) BRL-3 TOGETHER AND EPOXY IN PLACE (BOTTOM)
FUEL SIGHT GAUGE
A
B
C
D
TEMP. 5/8" BLOCKS OF FOAM ALONG TANK OUTLINE BOTTOM
SEE SECT J-J (TYP.)

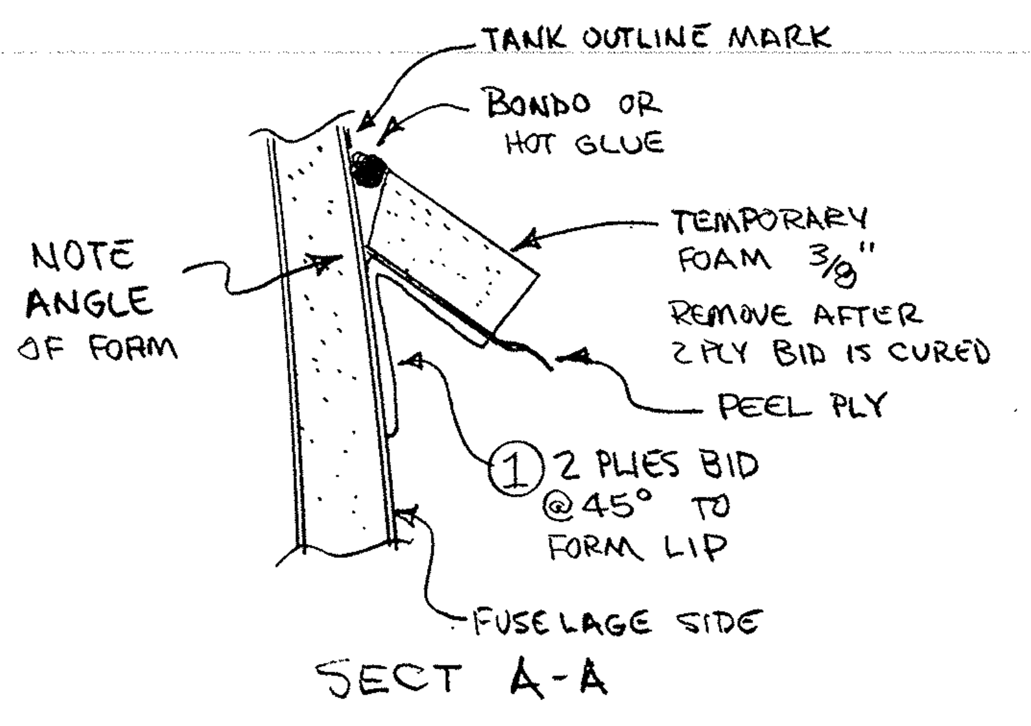



OUTSIDE FUSELAGE SKIN 2 PLIES UND
① 2 PLY BID LIP SEE SECT B-B "AFTER FOAM IS REMOVED"
5/8" R45
REPAINT ENTIRE FUSELAGE SIDE INSIDE TANK W/ PURE EPOXY TO SEAL AGAINST LEAKS
INSIDE FUSELAGE 1 PLY BID @ 45°
1 PLY BID @ 45° 2" WIDE TAPE (TYP.) (WET)
1 PLY BID @ 45° INSIDE TANK SKIN (WET LAYUP)
MICRO
3/8" R45 FOAM BOTTOM
OUTLINE OF BOTTOM OF FUEL TANK
TEMP. 5/8" FOAM BLOCK TO HOLD BOTTOM FOAM IN PLACE

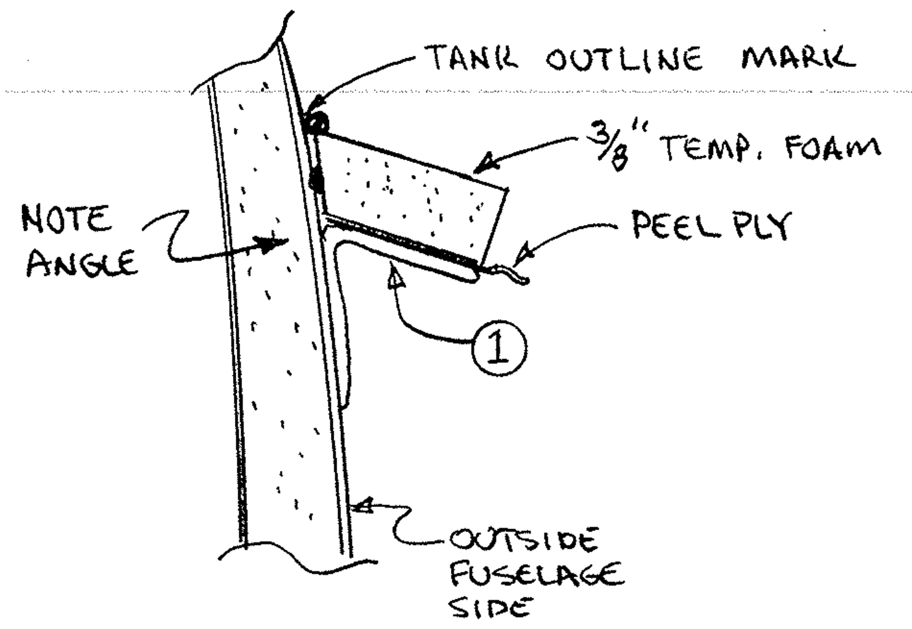
SECT J-J


① 2 PLY BID LIP
(TYPICAL) 1 PLY BID OVER WET FLOX
3/8" X .035 3003-O ALUM. MAIN TANK VENT TO SUMP TANK
2 PLIES UND
1 PLY BID OVER VENT TUBE
PAINT ENTIRE SIDE (INSIDE) OF TANK WITH EPOXY TO SEAL AGAINST LEAKS
5/8" R45 FUSELAGE SIDE
③ 1 PLY BID OVER WET FLOX
SCREEN 16 MESH BRASS
WET FLOX
② 1 PLY BID (TANK SKIN)
AIR VENT TO SUMP TANK
FUEL OUTLET MAIN TANK TO SUMP TANK 1/2" X .035 3003-O ALUM.
TEMP. 5/8" FOAM BLOCK

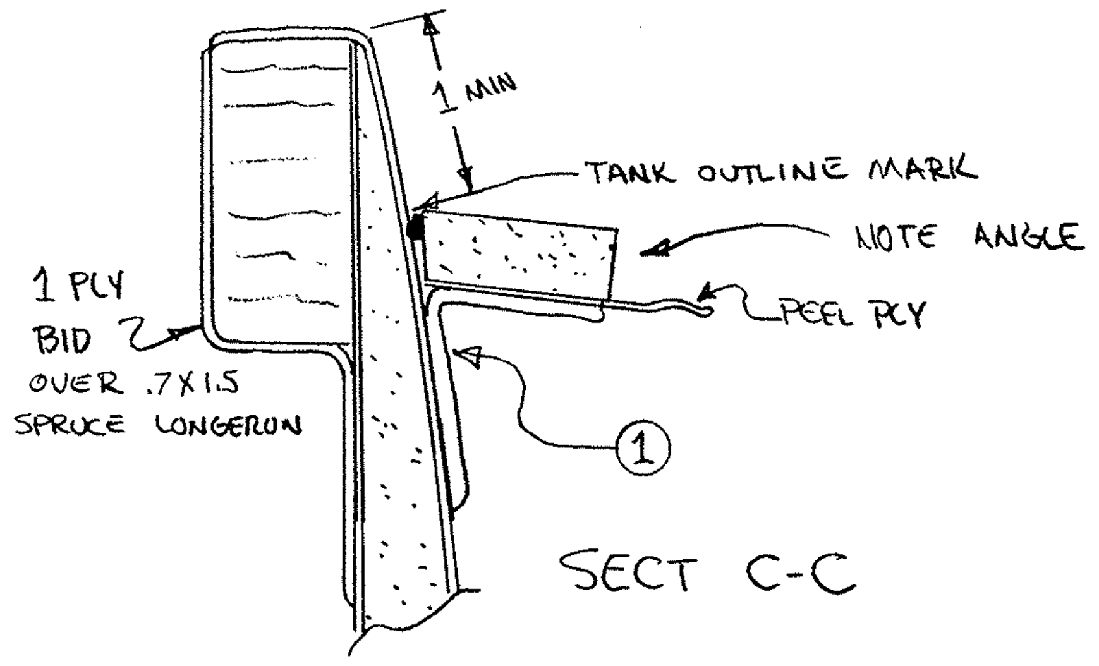
SECT. K-K


TANK OUTLINE MARK
BONDO OR HOT GLUE
TEMPORARY FOAM 3/8" REMOVE AFTER 2 PLY BID IS CURED
PEEL PLY
NOTE ANGLE OF FOAM
① 2 PLIES BID @ 45° TO FORM LIP
FUSELAGE SIDE

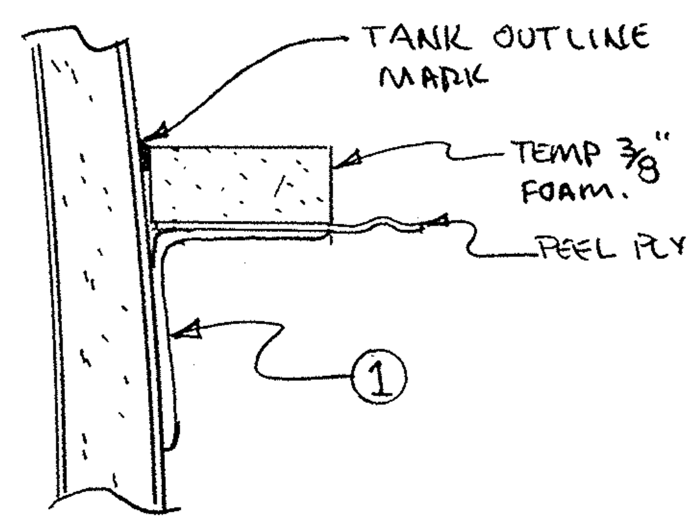
SECT A-A



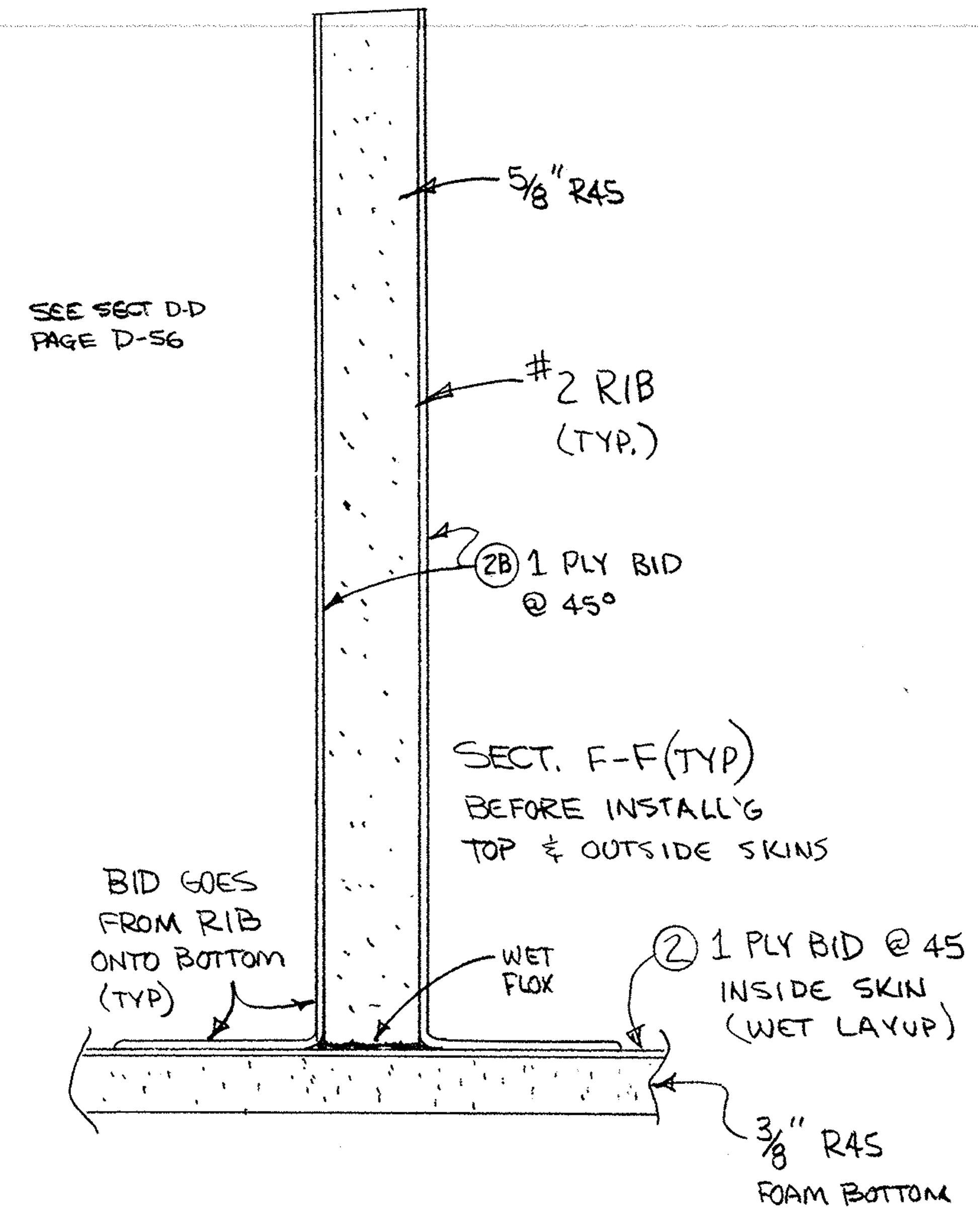
SECT. B-B



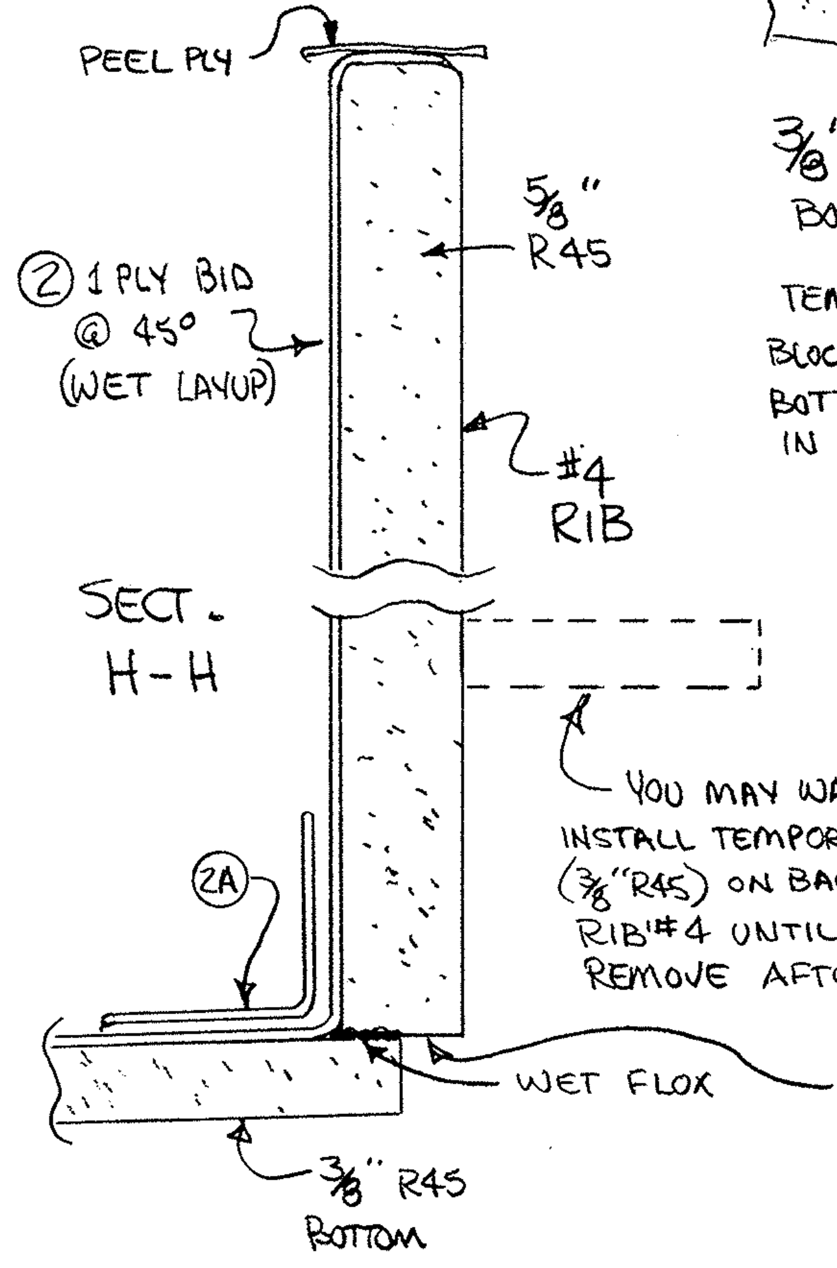
SECT C-C



SECT - D-D

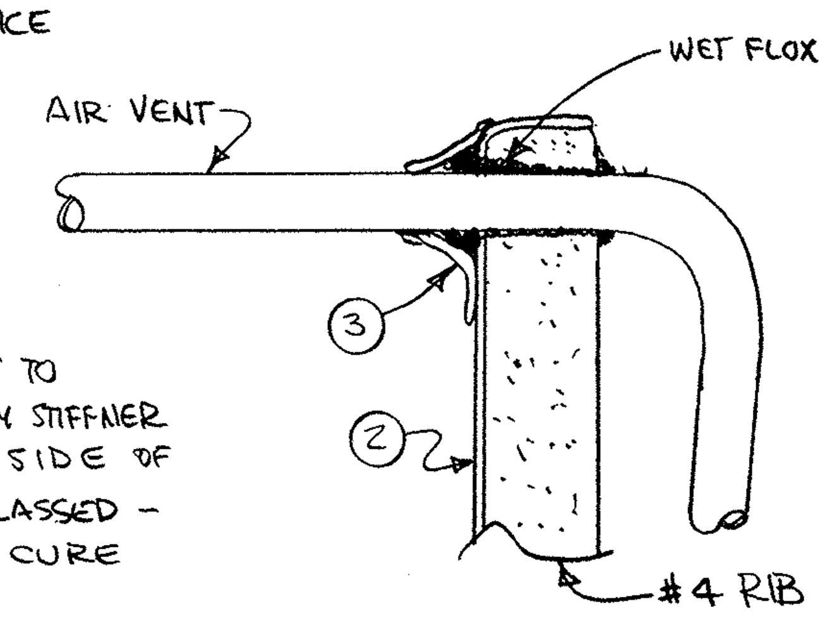


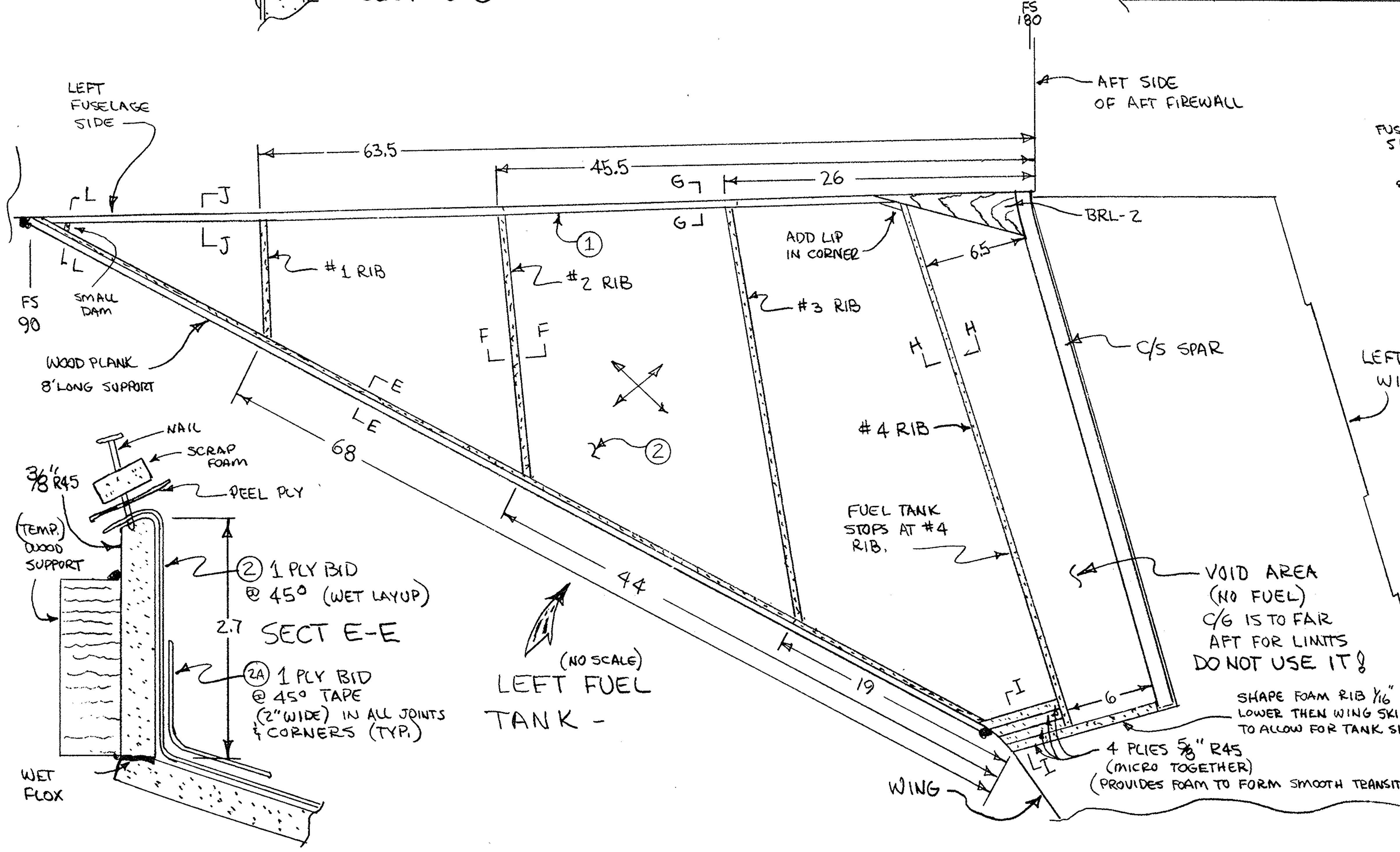
SECT. F-F (TYP) BEFORE INSTALL'G TOP & OUTSIDE SKINS


PEEL PLY
5/8" R45
② 1 PLY BID @ 45° (WET LAYUP)
#4 RIB
(2A)
3/8" R45 BOTTOM
WET FLOX
YOU MAY WANT TO INSTALL TEMPORARY STIFFNER (3/8" R45) ON BACK SIDE OF RIB #4 UNTIL GLASSED - REMOVE AFTER CURE

SECT. H-H

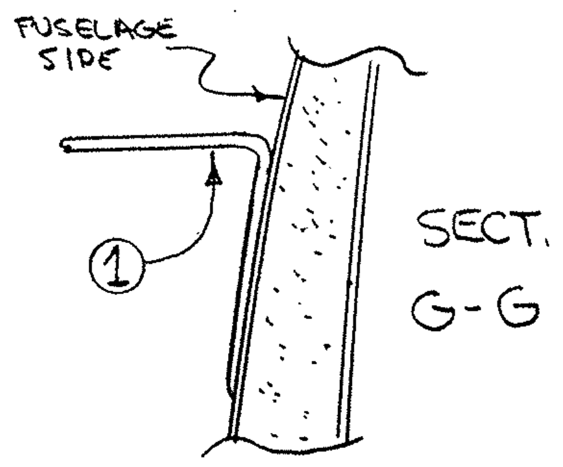
NOTE ONLY HALF THICKNESS OF 5/8" #4 RIB IS USED FOR BOTTOM 3/8"



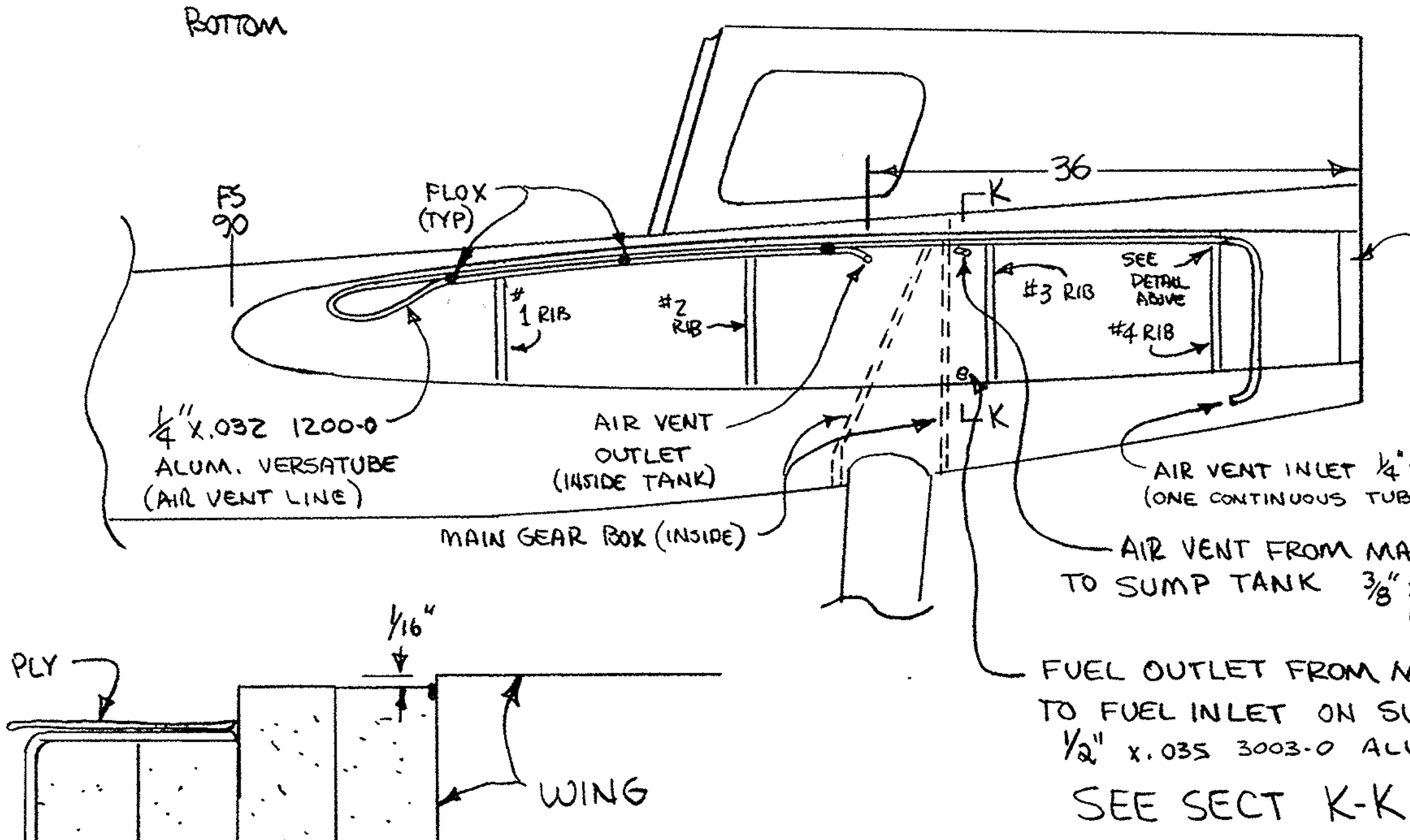

FS 180
AFT SIDE OF AFT FIREWALL
LEFT FUSELAGE SIDE
63.5
45.5
26
G
L
J
FS 90
SMALL DAM
#1 RIB
①
#2 RIB
ADD LIP IN CORNER
#3 RIB
65
BRL-2
C/S SPAR
F
H
WOOD PLANK 8' LONG SUPPORT
E
68
②
#4 RIB
LEFT WING
FUEL TANK STOPS AT #4 RIB.
44
19
VOID AREA (NO FUEL) C/G IS TO FAR AFT FOR LIMITS DO NOT USE IT!
I
6
SHAPE FOAM RIB 1/16" LOWER THEN WING SKIN TO ALLOW FOR TANK SKIN
4 PLIES 5/8" R45 (MICRO TOGETHER) (PROVIDES FOAM TO FORM SMOOTH TRANSITION TO WING)
WING
NAIL
SCRAP FOAM
3/8" R45
PEEL PLY
(TEMP) WOOD SUPPORT
② 1 PLY BID @ 45° (WET LAYUP)
2.7
(2A) 1 PLY BID @ 45° TAPE (2" WIDE) IN ALL JOINTS & CORNERS (TYP.)
WET FLOX

SECT E-E

(NO SCALE) LEFT FUEL TANK -



SECT. G-G

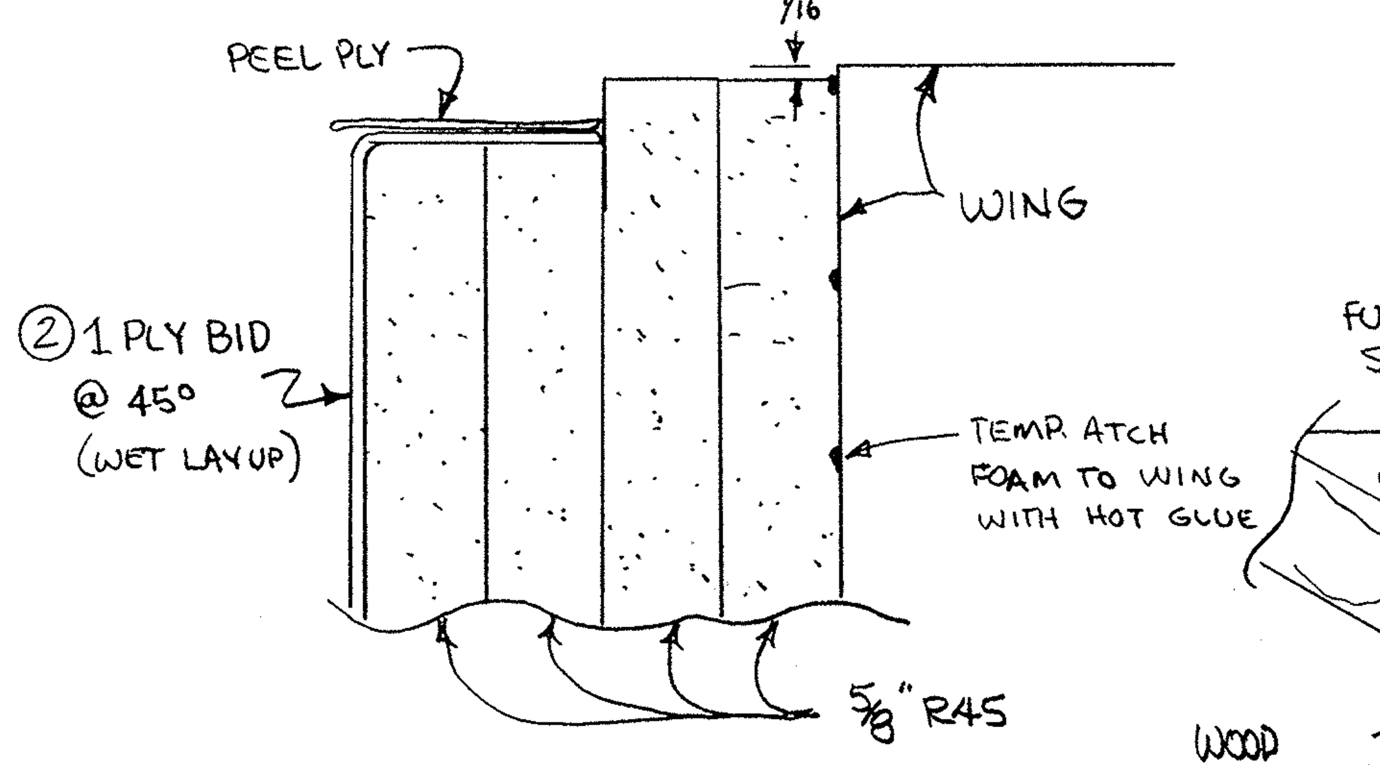

FS 90
FLOX (TYP)
K
36
1 RIB
#2 RIB
#3 RIB
SEE DETAIL ABOVE
#4 RIB
MAIN CENTER SECTION SPAR
1/4" X .032 1200-O ALUM. VERSATUBE (AIR VENT LINE)
AIR VENT OUTLET (INSIDE TANK)
MAIN GEAR BOX (INSIDE)
AIR VENT INLET 1/4" X .032 1200-O ALUM (ONE CONTINUOUS TUBE FROM INLET TO OUTLET)
AIR VENT FROM MAIN TANK TO SUMP TANK 3/8" X .035 3003-O ALUM
FUEL OUTLET FROM MAIN TANK TO FUEL INLET ON SUMP TANK 1/2" X .035 3003-O ALUM.

SEE SECT K-K

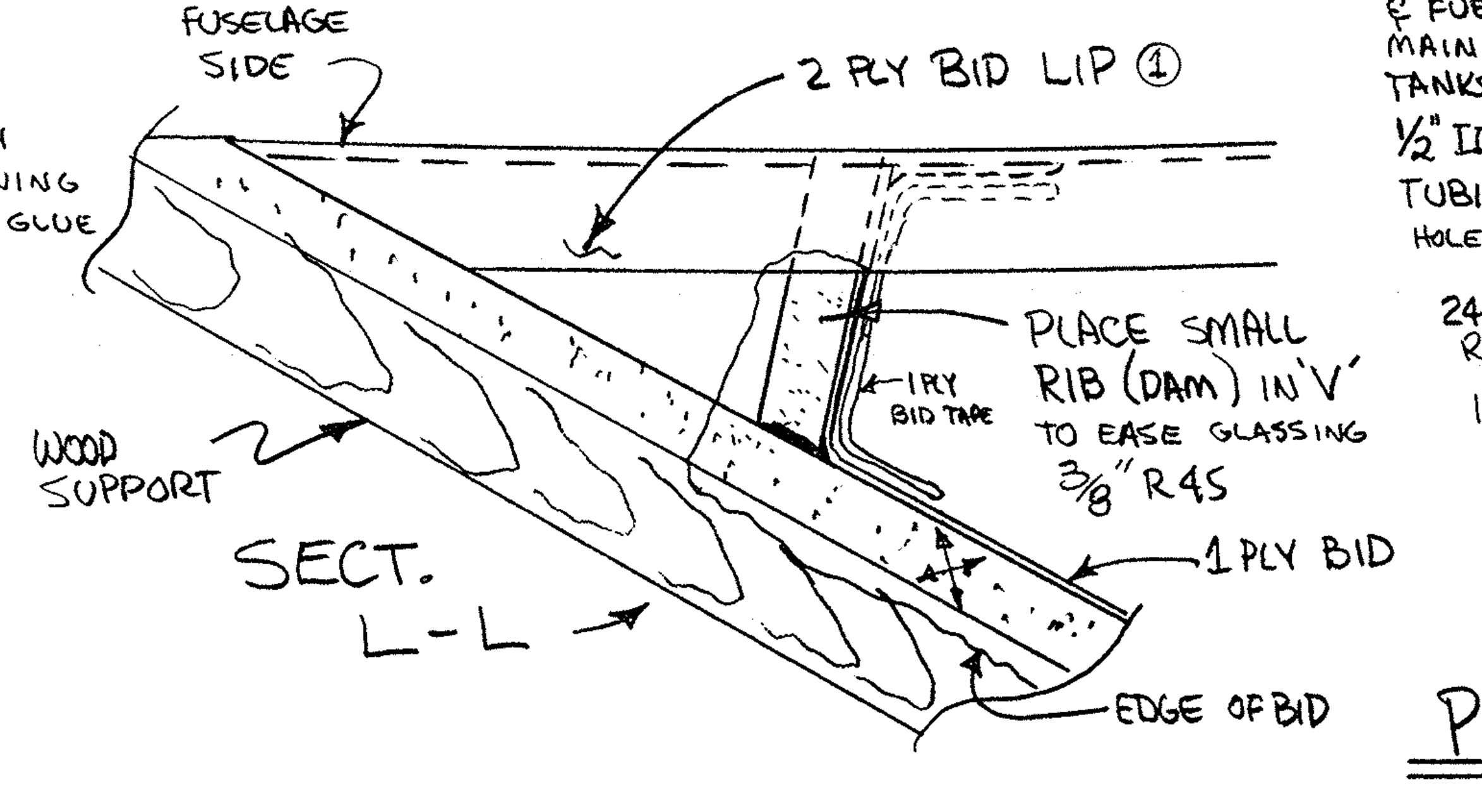
→ CONNECT VENT & FUEL LINES FROM MAIN TANKS TO SUMP TANKS WITH 5/8" OD 1/2" ID. POLYURETHANE TUBING & #6504 HOSE CLAMPS

24" POLYURETHANE REQ'D

12 EA. #6504 CLAMPS REQ'D


PEEL PLY
1/16"
WING
② 1 PLY BID @ 45° (WET LAYUP)
TEMP ATCH FOAM TO WING WITH HOT GLUE
5/8" R45

SECT I-I



SECT. L-L

(SLURRY ALL FOAM) BEFORE GLASSING TYP.

TOP SKIN (INSTALL FUEL FLANGE BEFORE ⑦)

⑦ 2 PLIES UND OVER ENTIRE TANK SURFACE PLUS 1 PLY UND @ ENTRY-EXIST AREA ALL @ ORIENT. SHOWN

② 1 PLY BID @ 45° ON ALL INSIDE SURFACES PLUS 2" WIDE 1 PLY BID TAPE ALONG ALL JOINING EDGES & CORNERS (THE TAPE DOES NOT APPLY TO INSIDE EDGES OF TOP LID)

REMOVE WOOD SUPPORT & PLACE 2 lb/FT³ URETHANE OR 2 PLIES 5/8" R45 & 1 PLY OF 3/8" R45-MICRO IN PLACE AND SHAPE

LAYUP ⑨

AFTER MAIN FUEL TANKS HAVE BEEN SKINNED (TOP & BOTTOM) LAYUP TEN STRIPS (PLIES) OF UND 4" WIDE. LAP ONTO WING TANK & FUSELAGE SIDES AS SHOWN - ALL 10 STRIPS CARRY ON TO BOTTOM SIDE OF TANK WITH SAME PATTERN & LENGTH AS TOP SIDE. ⑨

AFTER TEN STRIPS ARE CURED INSTALL WA-3 & WA-3A W/ REQ'D. BOLTS

TOP SKINS LAP ONTO FUSELAGE SIDE AND TURTLE DECK TO FINALLY GLASS TURTLE DECK TO FUSELAGE "TUB" — EXTEND SKIN ONTO TURTLE DECK 1.5" MIN.

AFTER SKINNING TOP & BOTTOM OF TANK LAYUP 4 STRIPS (PLIES) OF 4" WIDE UND AS SHOWN - CARRY STRIPS ON TO BOTTOM SIDE USING SAME PATTERN AS TOP SIDE. AFTER CURE RECUT HOLES IN END (AS SHOWN) & INSTALL WA4 & WA-4A PLATES W/ REQ'D BOLTS (SEE D-30)

FUEL CAP FLANGE (CLEAN & ROUGH MOUNTING SURFACE WITH SANDPAPER) DO NOT SAND THROAT OF FLANGE - CAP WILL NOT SEAL

3" UNVENTED CAP & FLAT FLANGE #416-51AB (2 REQ'D)

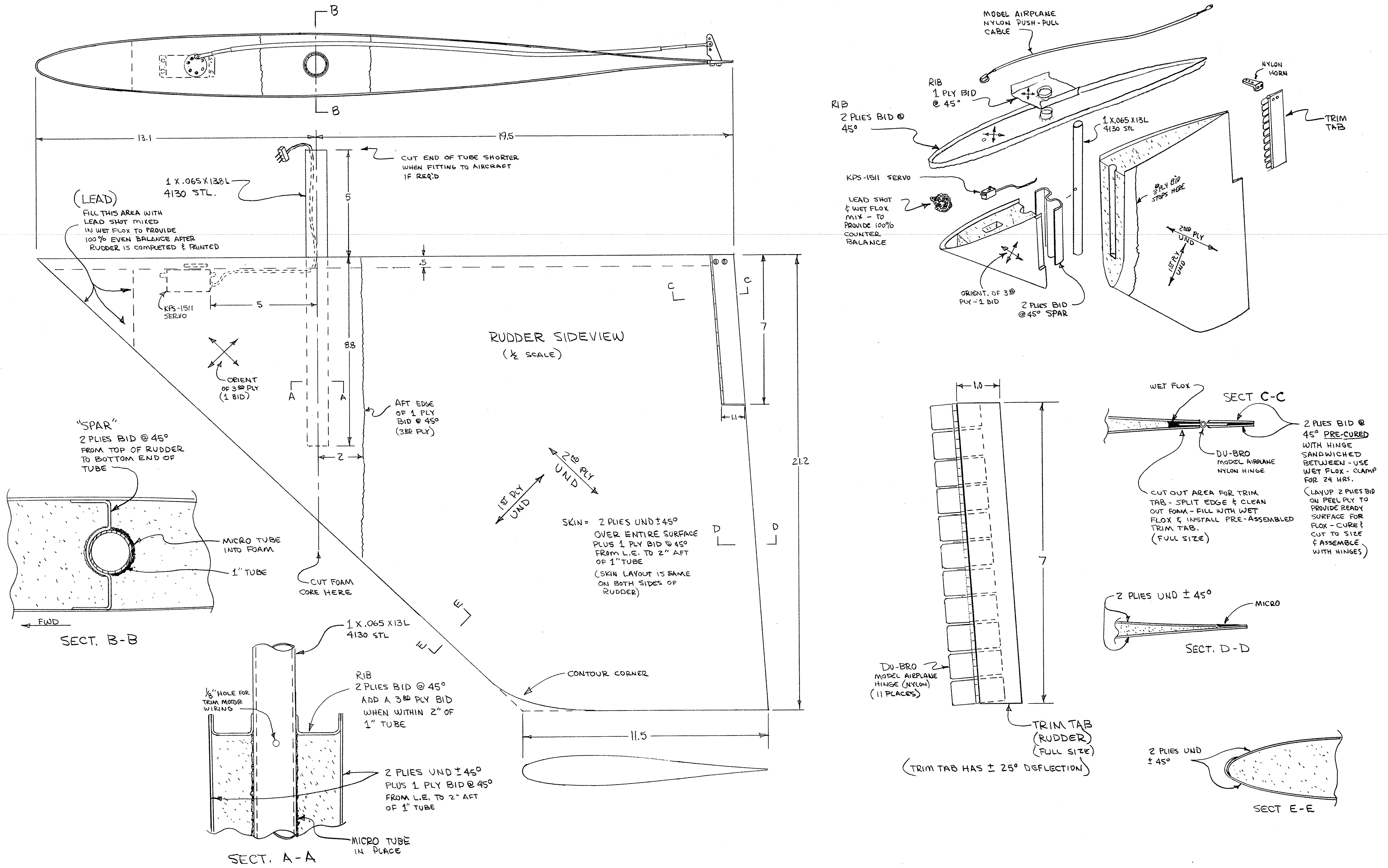
RECESS 3/8" R45 FOAM 1/16" DEEP X 6" OD - CUT 3 1/4" HOLE IN FOAM & THRU INSIDE SKIN - CAREFULLY VACUUM TANK TO PICK ALL DUST & SCRAPS - DO LAYUP ⑦ & WHILE WET ADD WET FLOX TO RECESS AND INSTALL FLANGE WITH 1 PLY BID RING PLACED AS SHOWN (USE CARE NOT TO DROP WET FLOX ONTO FUEL OUTLET SCREEN THUS CLOGGING)

NOTE! USE SAME METHOD TO DO LAYUP ⑥ AS USED TO DO LAYUP ①

PLACE 3/8" TO 1/2" RIDGE OF WET FLOX ON LIP BEFORE PLACING LID

5/8" R45 END PIECE REPLACE FOAM REMOVED TO INSTALL WA 4 & WA-4A PLATES

REMOVE 1/4" FOAM & FLOX CORNER


B
B
13.1
19.5
CUT END OF TUBE SHORTER WHEN FITTING TO AIRCRAFT IF REQ'D
1 X .065 X 13.8L 4130 STL.
5
(LEAD)
FILL THIS AREA WITH LEAD SHOT MIXED IN WET FLOX TO PROVIDE 100% EVEN BALANCE AFTER RUDDER IS COMPLETED & PAINTED
.5
KPS-1511 SERVO
5
C
C
7
RUDDER SIDEVIEW
(½ SCALE)
8.8
ORIENT OF 3RD PLY (1 BID)
A
A
AFT EDGE OF 1 PLY BID @ 45° (3RD PLY)
1.1
2
2ND PLY UND
1ST PLY UND
21.2
"SPAR"
2 PLIES BID @ 45° FROM TOP OF RUDDER TO BOTTOM END OF TUBE
MICRO TUBE INTO FOAM
1" TUBE
FWD
SECT. B-B
CUT FOAM CORE HERE
SKIN = 2 PLIES UND ± 45° OVER ENTIRE SURFACE PLUS 1 PLY BID @ 45° FROM L.E. TO 2" AFT OF 1" TUBE
(SKIN LAYOUT IS SAME ON BOTH SIDES OF RUDDER)
D
D
E
E
1 X .065 X 13L 4130 STL
RIB
2 PLIES BID @ 45°
ADD A 3RD PLY BID WHEN WITHIN 2" OF 1" TUBE
⅛" HOLE FOR TRIM MOTOR WIRING
CONTOUR CORNER
11.5
2 PLIES UND ± 45° PLUS 1 PLY BID @ 45° FROM L.E. TO 2" AFT OF 1" TUBE
MICRO TUBE IN PLACE
SECT. A-A
MODEL AIRPLANE NYLON PUSH-PULL CABLE
RIB 1 PLY BID @ 45°
RIB 2 PLIES BID @ 45°
NYLON HORN
TRIM TAB
1 X .065 X 13L 4130 STL
KPS-1511 SERVO
LEAD SHOT & WET FLOX MIX - TO PROVIDE 100% COUNTER BALANCE
3RD PLY BID STOPS HERE
2ND PLY UND
1ST PLY UND
ORIENT. OF 3RD PLY - 1 BID
2 PLIES BID @ 45° SPAR
1.0
7
DU-BRO MODEL AIRPLANE HINGE (NYLON) (11 PLACES)
TRIM TAB (RUDDER) (FULL SIZE)
(TRIM TAB HAS ± 25° DEFLECTION)
WET FLOX
SECT C-C
2 PLIES BID @ 45° PRE-CURED WITH HINGE SANDWICHED BETWEEN - USE WET FLOX - CLAMP FOR 24 HRS.
(LAYUP 2 PLIES BID ON PEEL PLY TO PROVIDE READY SURFACE FOR FLOX - CURE & CUT TO SIZE & ASSEMBLE WITH HINGES)
DU-BRO MODEL AIRPLANE NYLON HINGE
CUT OUT AREA FOR TRIM TAB - SPLIT EDGE & CLEAN OUT FOAM - FILL WITH WET FLOX & INSTALL PRE-ASSEMBLED TRIM TAB.
(FULL SIZE)
2 PLIES UND ± 45°
MICRO
SECT. D-D
2 PLIES UND ± 45°
SECT E-E

(SLURRY ALL FOAM)

1.4
.8
.3
.7
KNIFE BLADE & WIPER MOUNTING BLOCK (MAKE TWO) HARD WOOD
KNIFE BLADE WITH (FULL SIZE) MAKE ONE STRAIGHT EDGE - EDGE MUST BE STRAIGHT WITHIN .0005 OVER THE 1.7" WIDTH NEAR THE WHEEL. BEVEL IS NOT CRITICAL.
EDGE NEED NOT BE CUTTING SHARP BUT STRAIGHT & TRUE
5/16" DIA. FOR ADJ. (2 PLACES)
1.8
3/16" (2 PLACES)
WIPER .063 TO .090 ALUM. OR STEEL FULL SIZE MAKE ONE
.5" STEEL SHAFT
4.5
FULL SIZE
1.7
6
.5
(MAKE ONE) WETTING WHEEL CAN BE MADE FROM STEEL OR ALUM. WITH 1/2" MIN SOLID STEEL SHAFT - NOTE PART HAS TO BE TRUE. ACCURATE MACHINING IS A MUST. MAX. TOTAL RUNOUT OF 1.7" SURFACE IS 0.001 IN.
MAKE FROM "SINK CUT OUT" (COUNTER TOP FOR KITCHEN)
THESE NAILS PROVIDE LATERAL SUPPORT TO 1" ROLLER. CUT HEAD OFF NAIL.
ALUM. RAMP.
'S' GLASS ROVING FEED OVER ALUM. RAMP UNDER 1" DIA. ROLLER.
1" DIA. SOLID ALUM. ROD. ROLLS BETWEEN NAILS AND PROVIDES DRAG FOR 'S' GLASS ROVING
ROVING FEEDS BETWEEN 3/16" RODS.
WIPER
MOUNTING BLOCK
KNIFE EDGE
WETTING WHEEL
.125 ALUM ANGLE
8
3.8
4
8
ALUM OR STEEL BRACKET
'S' GLASS ROVING STRANDS CONVERGE THROUGH "FUNNEL" WHICH FACILITATES WETTING PROCESS.
FUNNEL MUST BE ABSOLUTELY SMOOTH INSIDE - THIS IS IMPORTANT.
2.7
FULL SIZE
7.5
14
12
WORK SHOP CEILING
'S' GLASS ROVING
'S' GLASS SPOOLS (TYP.)
WOOD 2X4
(5) 1" DOWELS PLACED 1/4" APART
6" MIN. DIA. ROLLOR MADE WITH PLYWOOD DISC (END PLATES) COVERED WITH THIN ALUM.-TAPE SEAM WITH MASKING TAPE
PLYWOOD GUSSETT
AFT VIEW
'S' GLASS SPOOLS (ROVING)
1" WOOD DOWELS (TYP.)
SPIKE
96" 2X4'S
TRAVEL OF 'S' GLASS
SIDE VIEW
→ FWD.
WEDGE TO HOLD RACK
WORK FLOOR
NO SCALE ON SKETCHES
EPOXY PROPORTIONING MACHINE.
WET ROVING
WORK TABLE
ADJ. KNIFE BLADE TO WITHIN .010" TO .012" OF WHEEL TO PROVIDE FILM OF EPOXY TO WET 'S' GLASS
.010 TO .012 ADJUST WITH FEELER GAUGE.
5 EACH 3/16" RODS
WETTING WHEEL
NAIL PROVIDES LATERAL CENTERING.
FISHING LINE NYLON SPOOL 1 3/4" MIN. INSIDE DIA.
SOLID ALUM. ROD APPROX. 1.0" DIA. SUPPORTED BETWEEN 6 NAILS PROVIDE CORRECT 'DRAG' ON 'S' GLASS ROVING
DIRECTION OF TURN
KNIFE BLADE
WIPER
.7
1.2
END OF SMALL PLASTIC FUNNEL - CAUTION! MUST NOT HAVE ANY SHARP EDGES INSIDE.
SCREW
ALUM. FOIL
ROVING PATH
CUT BLOCKS FOR LEGS
ALUM. BREAD PAN - LINED WITH ALUM. FOIL TO AID CLEANING AND FORM EPOXY SUPPLY CLOSE TO WHEEL
FULL SIZE

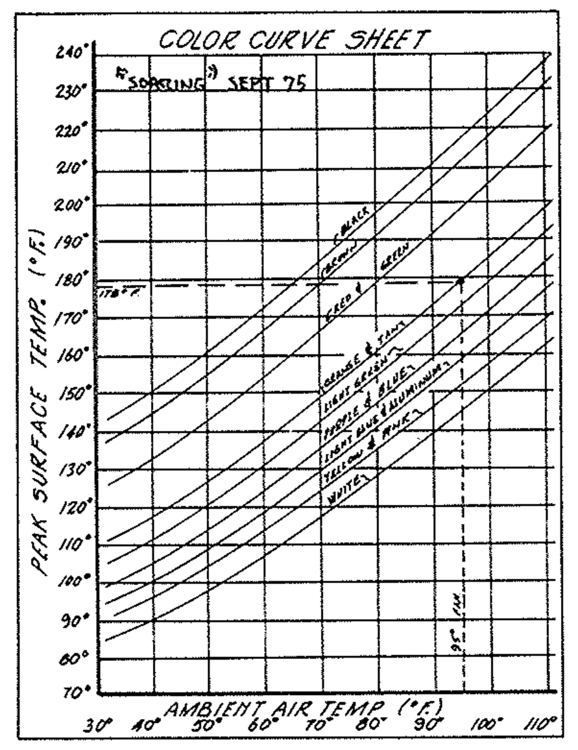
DO NOT MAKE ANY SHARP BENDS WITH 'S' GLASS (ALL RADIUS ARE SHOWN TO MIN. SIZE)

FINISHING

Finishing the composite airplane is more important than simply obtaining an attractive paint job. The finish on a composite aircraft serves to protect the structure from weathering and deterioration from ultra violet radiation (sunlight). The finishing materials also give the airplane its aerodynamic shape. Using the proper materials and techniques, the finishing process is fast, pleasing (both esthetically and aerodynamically), and provides for long maintenance-free service. Use of sub-standard materials can limit the life of the finish, result in an overweight airplane, or even limit the service life of the airframe. Sanding is done constantly during the finishing process and extreme caution must be exercised to avoid damaging the structure. A poorly executed finishing job can destroy the structural integrity of the airframe. Even the finished color of the composite aircraft can effect its structure. Proper techniques must be adhered to for safety as well as to obtain an attractive airplane.

FINISH COLORS AND HEAT

Epoxies and foams are all sensitive to high temperatures. Room temperature curing epoxies soften and lose their rigidity at only moderate temperatures (160°F). Foams are also heat sensitive and tend to soften and swell with moderately elevated temperature (240° F). The sun is a potential source of heat. In still air, on a hot sunny day it is possible to obtain surface temperatures that approach 220° F on a black airplane. Color of the surface determines how much solar heat it will absorb. White surfaces absorb very little (10%) of the sun's heat while a black surface (95% absorption) will heat up tremendously. The accompanying graph shows the relationship between color and surface temperature. White has been chosen as the only color for fiberglass sailplanes by the manufacturers to preclude any possiblity of excess temperature due to solar heating. The same criteria applies to the Defiant. White is the only recommended color for this aircraft.



Dark trim colors are definitely not approved on the upper surface of the wings and canard. Do not stripe the wing or canard with trim, except at the canard or wing tip where structure is not critical. Dark trim may be applied to the fuselage, however go easy even here. Keep the area of dark color small and stay away from very dark colors ie, black or very dark blue.

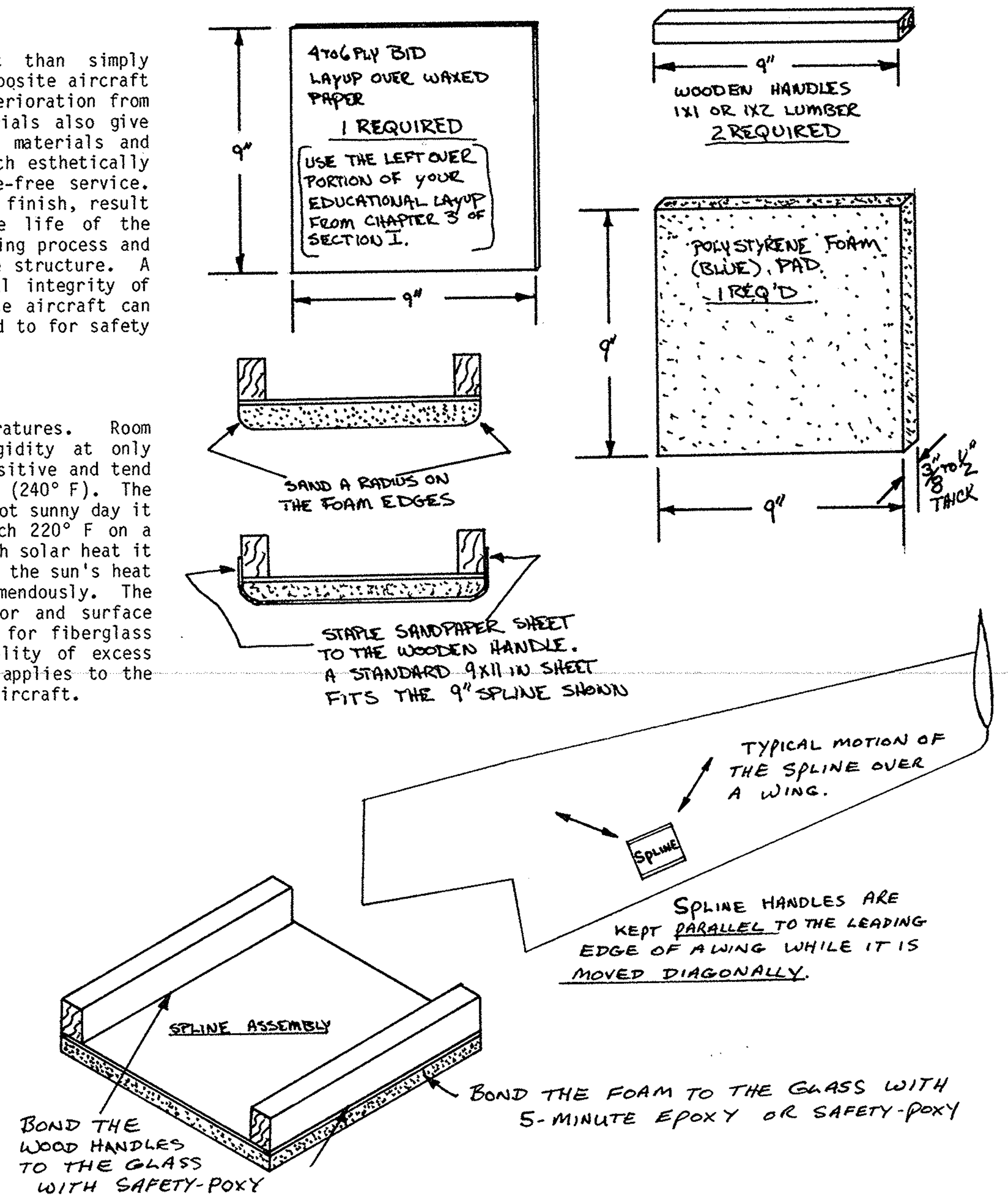
TOOLS AND MATERIALS

A low density microsphere/epoxy mixture (dry micro) is used for coarse filling requirements. Automotive type polyester body fillers (Bondo) are very heavy and not recommended for aircraft finishing work. One product that works fast like Bondo, and is light like dry micro is Stitts micro putty. It can also be used for minor contour filling, but is not a replacement for dry micro. Medium to light surface filling (less than .030) can be done with any one of three materials that we have used and recommend. Feather Fill is a polyester based material that has been used for several years as the medium fill material. It is probably the least expensive of the medium fill materials and has been used successfully by hundreds of builders. Feather Fill normally requires an overnight cure before sanding. Sterling is a two part urethane primer filler. This material is the most expensive of the fillers but has the best adhesion qualities and can be sanded in 45 minutes. Morton Eliminator is another polyester based material but the cure time is around 4 hours and when properly used fills most of the pinholes with a single application. Dupont 131S acrylic, dark gray lacquer primer/surfacer provides an effective ultra violet radiation barrier. The topcoat paint is a builder preference item. Past designs have been painted with most types of automotive paint, acrylic lacquer, acrylic enamels and polyurethanes. The polyurethanes tend to have the best adhesion and film strength properties as well as the longest life. They are however the most expensive and difficult to repair. Taking all into account, they are probably best suited to a Defiant project with the catalized acrylic enamels being a good second choice. When using these products, be very careful with them. Read the company literature and follow the safety guide lines.

Sanding will occupy a large percentage of the time spent finishing the composite aircraft. Sand paper in 36 to 60 grit, 100-grit, 220-grit, 320-grit and 400-grit roughness will be used. Standard 9" x 11" sheets are the most versatile. Use a good quality aluminum oxide, or silicone carbide sandpaper. Don't waste your money on the cheap flint-type sandpapers. Power sanders are not recommended; it is too easy to damage the structure while using them. Hard (wood) and soft (foam) sanding blocks and the sanding spline will be your primary finishing tools. A paint spraying set up will be needed for the U.V. barrier primer and finish painting. Some hand brushing of fillers will also be done.

The Spline

The sanding spline is a finishing tool common to the airplane industry. It is an easy tool to make and does an excellent job of contouring. You may find it handy to make two, one for coarse grit sandpaper and one for medium or fine sanding. The spline is an easy tool to use but it may require your close attention at first. The spline is always held with handles parallel to the leading edge of an airfoil surface (wing, canard etc) as shown in the sketch. The sanding motion is on a diagonal to the leading edge while the spline's handles are held parallel. This takes a little getting used to, but becomes second nature after a little practice.


4 TO 6 PLY BID
LAYUP OVER WAXED PAPER
1 REQUIRED
USE THE LEFT OVER PORTION OF YOUR EDUCATIONAL LAYUP FROM CHAPTER 3 OF SECTION I.
9"
9"
9"
WOODEN HANDLES
1X1 OR 1X2 LUMBER
2 REQUIRED
POLYSTYRENE FOAM (BLUE), PAD
1 REQ'D
9"
9"
3/8" TO 1/2" THICK
SAND A RADIUS ON THE FOAM EDGES
STAPLE SANDPAPER SHEET TO THE WOODEN HANDLE.
A STANDARD 9X11 IN SHEET FITS THE 9" SPLINE SHOWN
TYPICAL MOTION OF THE SPLINE OVER A WING.
SPLINE
SPLINE HANDLES ARE KEPT PARALLEL TO THE LEADING EDGE OF A WING WHILE IT IS MOVED DIAGONALLY.
SPLINE ASSEMBLY
BOND THE WOOD HANDLES TO THE GLASS WITH SAFETY-POXY
BOND THE FOAM TO THE GLASS WITH 5-MINUTE EPOXY OR SAFETY-POXY

The Finishing Process

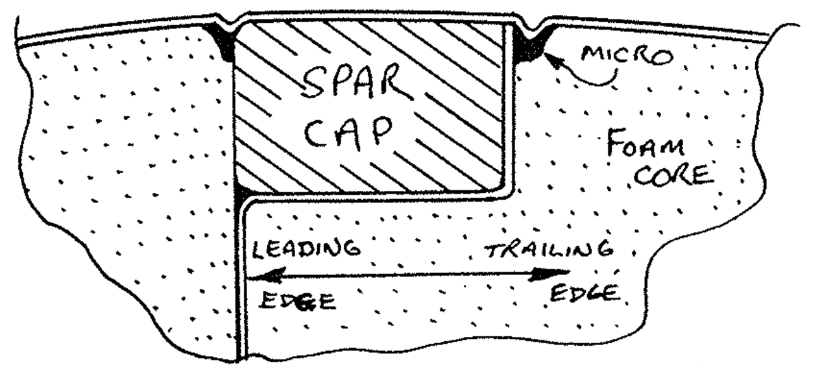
Finishing the composite aircraft is a five-step operation. Repairs or rework of structure must be completed first before the obscuring finish is applied, and final structural inspections must be complete. Second, coarse contour filling is done with micro mixed with epoxy (dry micro) as required in areas requiring .03" to .20" of fill. Any exceptionally gross filling (over .20) is also accomplished at this stage using a foam filler. The initial contour sanding begins with the cured microsphere filler and exceptional caution must be exercised to avoid damaging the structural skins while sanding. Third, Feather Fill is applied to fill medium sized surface defects up to .03, and as a general fill of the glass surface weave. The fourth step is the application of an ultra violet barrier primer. Fifth, the final finish paint is applied.

The following sketches are descriptive of the finishing process and its potential pit falls. The sketches are grossly exaggerated scale to show details more clearly.

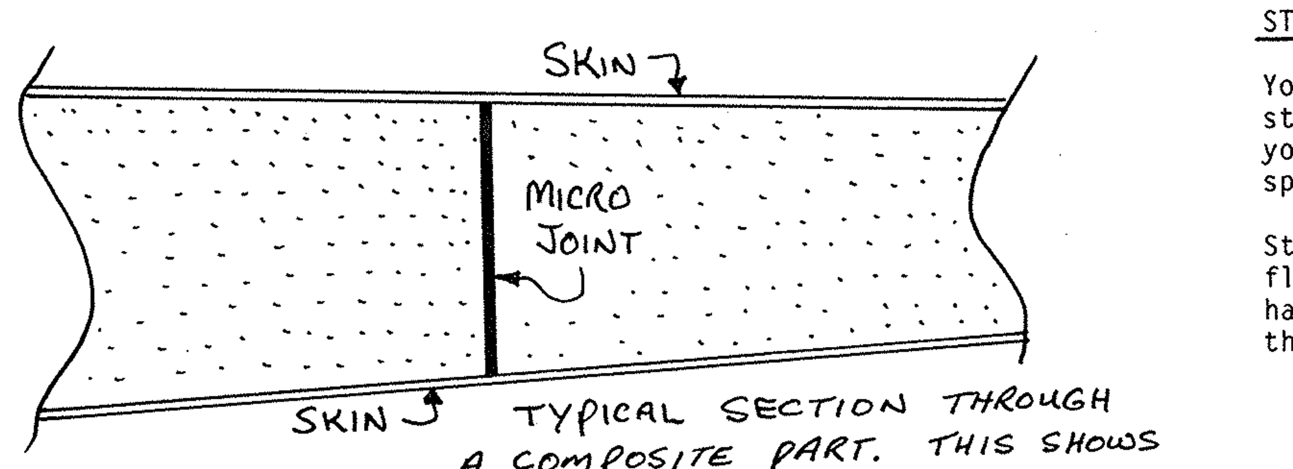
STEP I - Inspection/Repairs

When you begin finishing, the entire structure must be airworthy. You can hide poor workmanship from your own eyes and from the inspector who will finally approve your first flight, but you can't fool mother nature! Everything has to be structurally sound before finish materials are applied. The following sketches are a review and clarification of the quality control criteria found on Page B-5. Each airplane must have a thorough inspection and required repairs completed as the first step in finishing. Comply with the 12" ruler check before continuing.

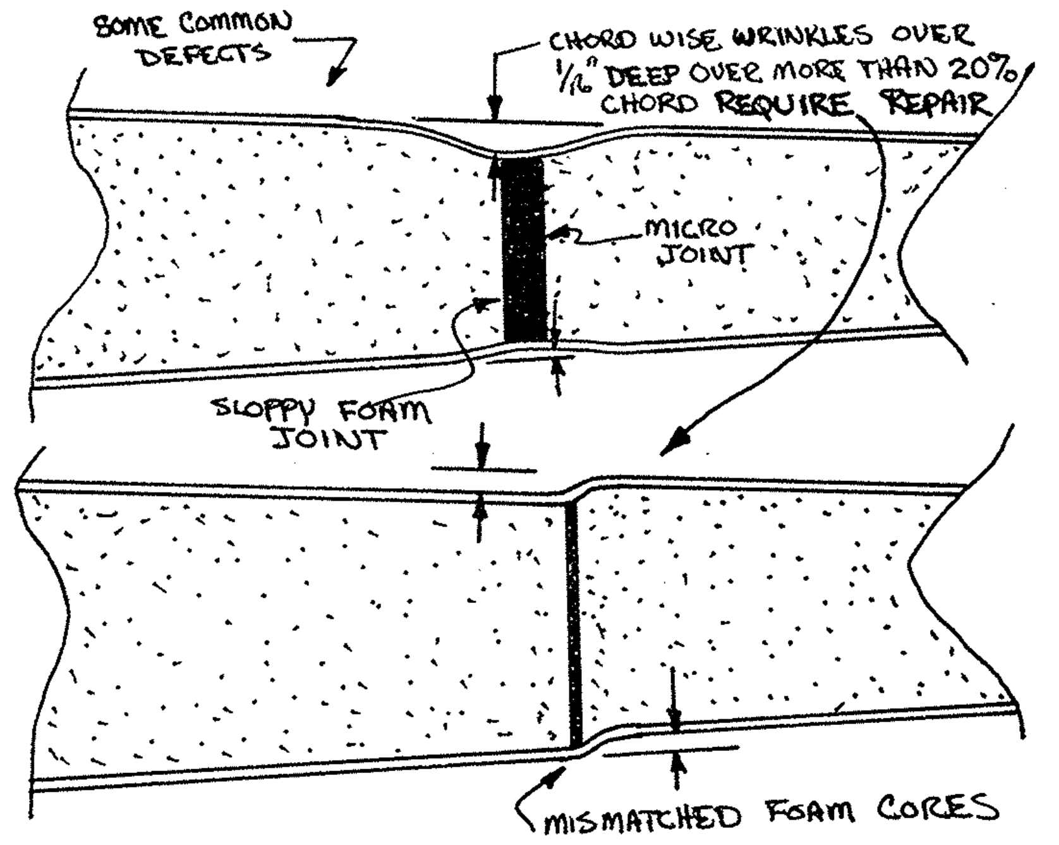
MINOR WRINKLES ALONG THE FORE AND AFT EDGES OF SPAR CAPS IS NORMAL AND ACCEPTABLE.

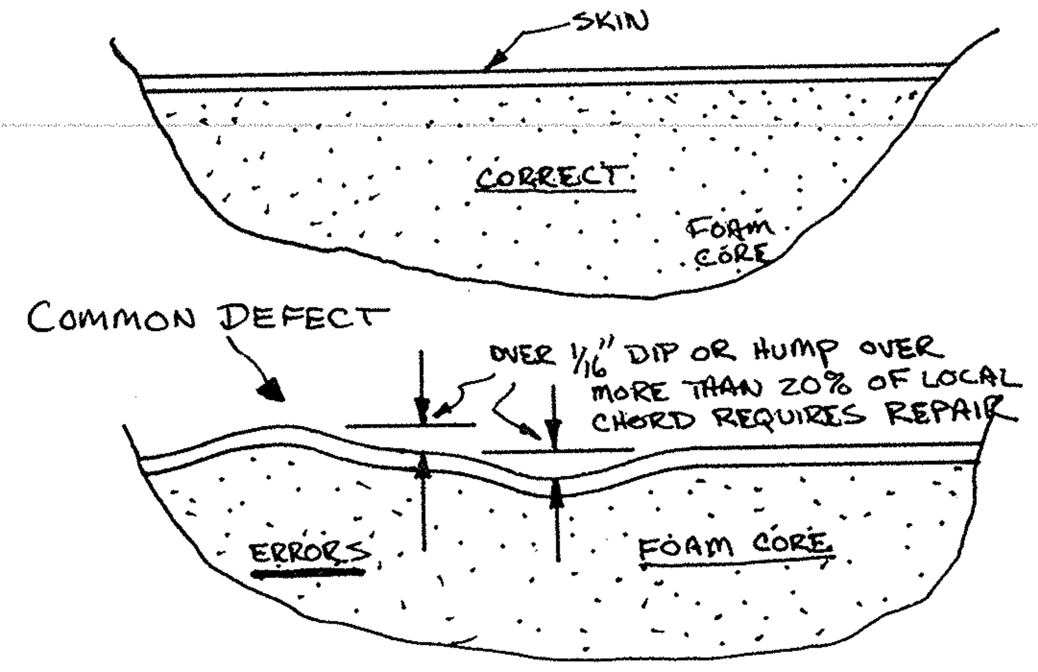


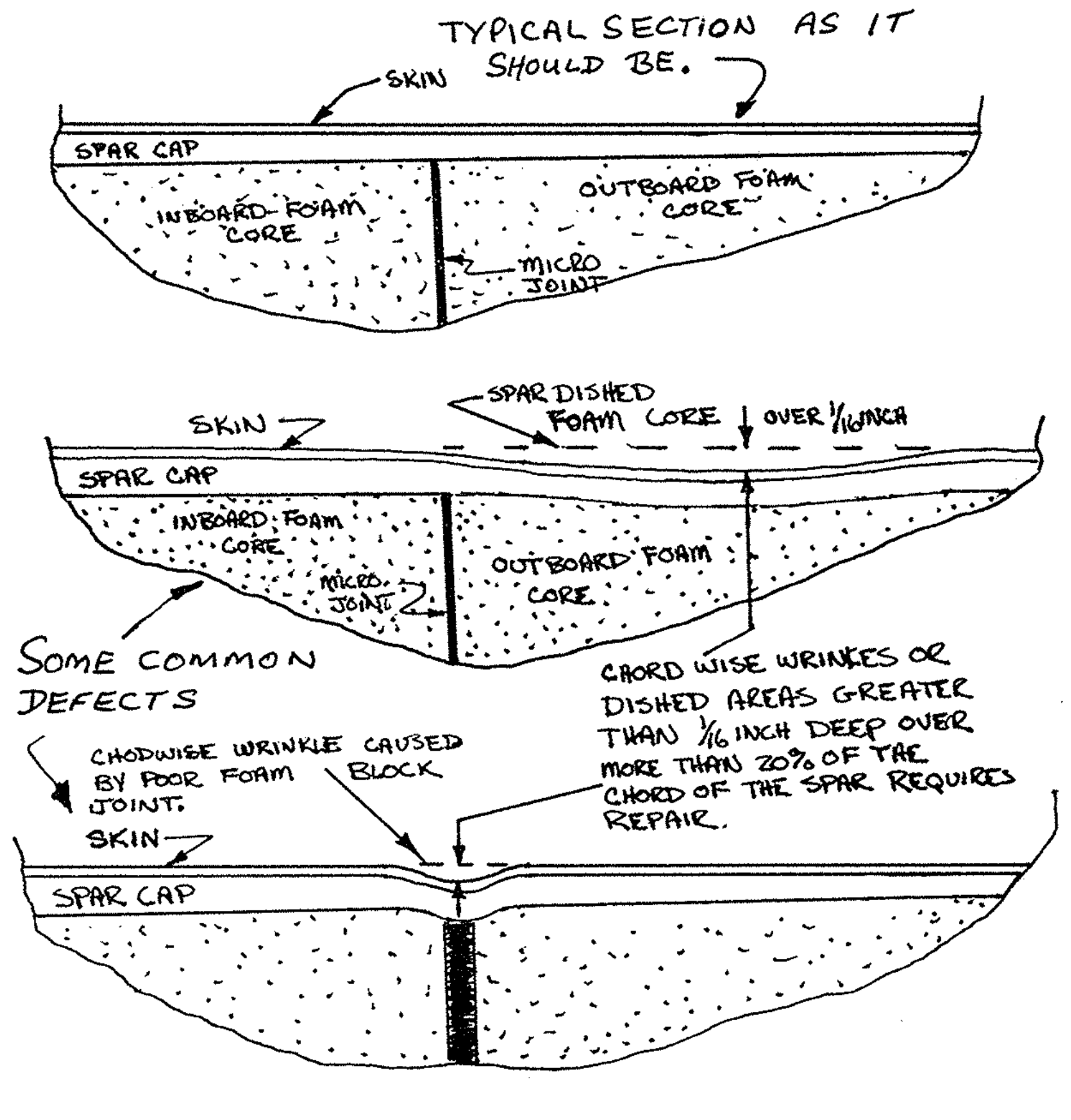
TYPICAL SECTION THROUGH A DEFIANT WING SPAR.

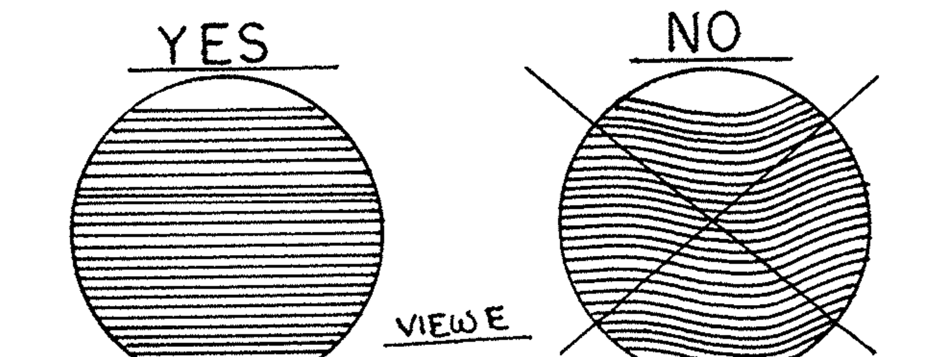


TYPICAL SECTION THROUGH A COMPOSITE PART. THIS SHOWS GOOD TECHNIQUE AND AN ACCEPTABLE FOAM JOIN AND SKIN SMOOTHNESS


SOME COMMON DEFECTS
CHORD WISE WRINKLES OVER 1/16" DEEP OVER MORE THAN 20% CHORD REQUIRE REPAIR
MICRO JOINT
SLOPPY FOAM JOINT
MISMATCHED FOAM CORES


SKIN
CORRECT
FOAM CORE
COMMON DEFECT
OVER 1/16" DIP OR HUMP OVER MORE THAN 20% OF LOCAL CHORD REQUIRES REPAIR
ERRORS
FOAM CORE


TYPICAL SECTION AS IT SHOULD BE.
SKIN
SPAR CAP
INBOARD FOAM CORE
OUTBOARD FOAM CORE
MICRO JOINT
SKIN
SPAR DISHED
FOAM CORE
OVER 1/16 INCH
SPAR CAP
INBOARD FOAM CORE
MICRO JOINT
OUTBOARD FOAM CORE
SOME COMMON DEFECTS
CHORD WISE WRINKES OR DISHED AREAS GREATER THAN 1/16 INCH DEEP OVER MORE THAN 20% OF THE CHORD OF THE SPAR REQUIRES REPAIR.
CHODWISE WRINKLE CAUSED BY POOR FOAM JOINT.
BLOCK
SKIN
SPAR CAP



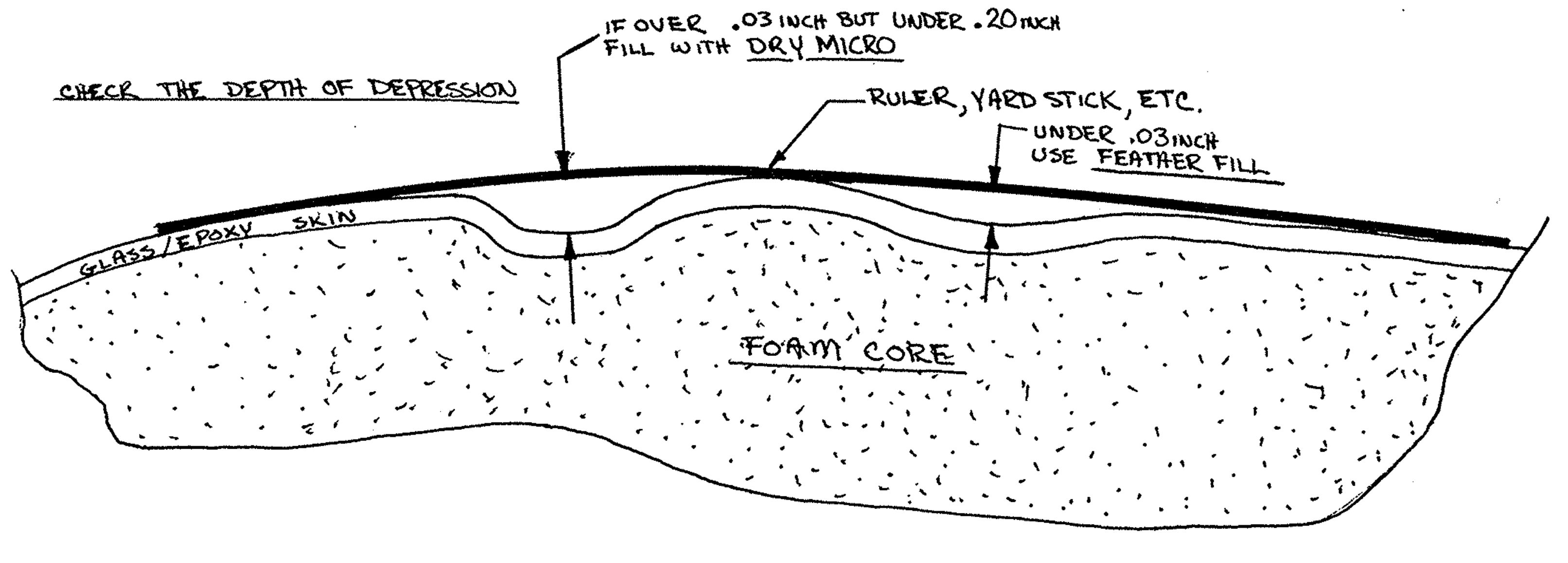
THE UNIDIRECTIONAL FIBERS SHOULD BE STRAIGHT AS SHOWN ABOVE

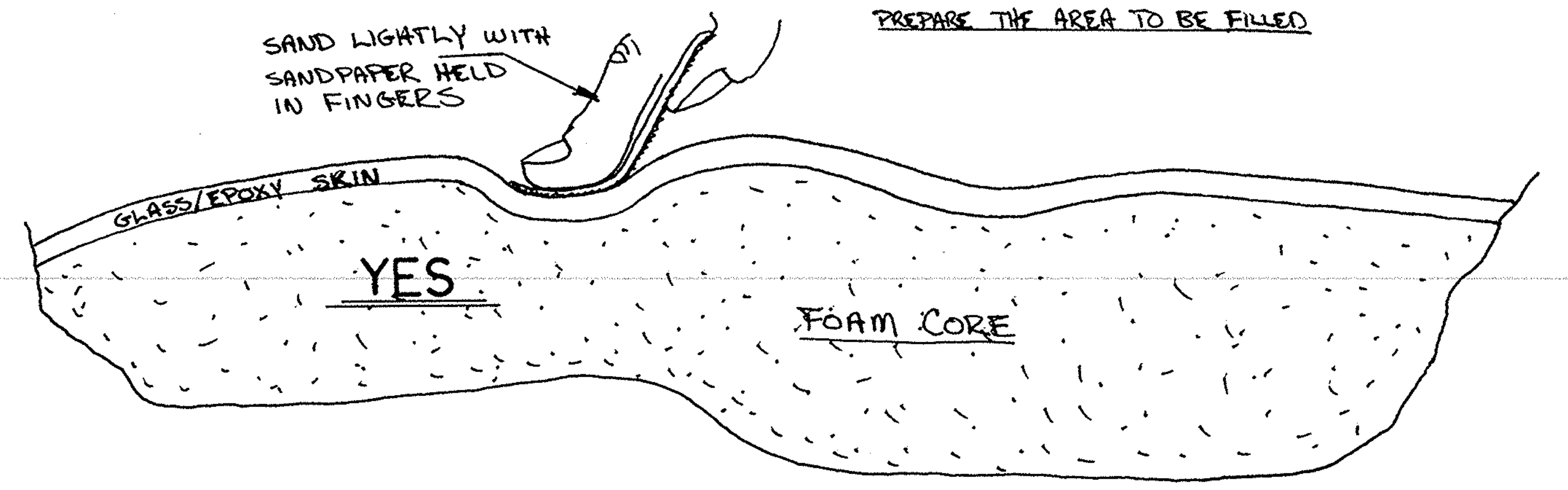
THE FIBERS SHOULD NOT BE DISRUPTED OR CROOKED AS SHOWN HERE.

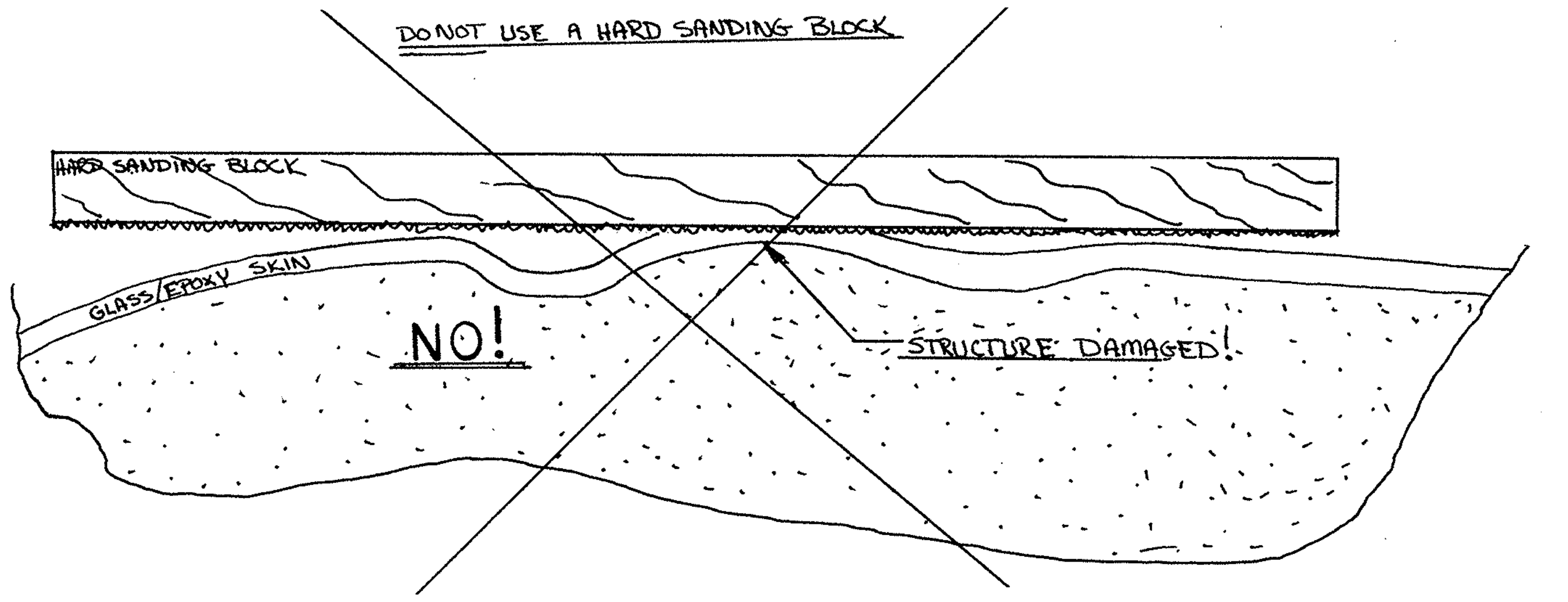
STEP II - Coarse Filling

You must be extra cautious in this step or you may destroy your structure. When you take a piece of sandpaper and start grinding on your composite structure, it is like using acid to clean a metal wing spar. It must be done carefully!

Start by determining which areas require micro filler as shown using a flexible yard stick and a scale. Prepare the areas to be filled by hand sanding lightly. Do not try to use a sanding block or spline on these areas.

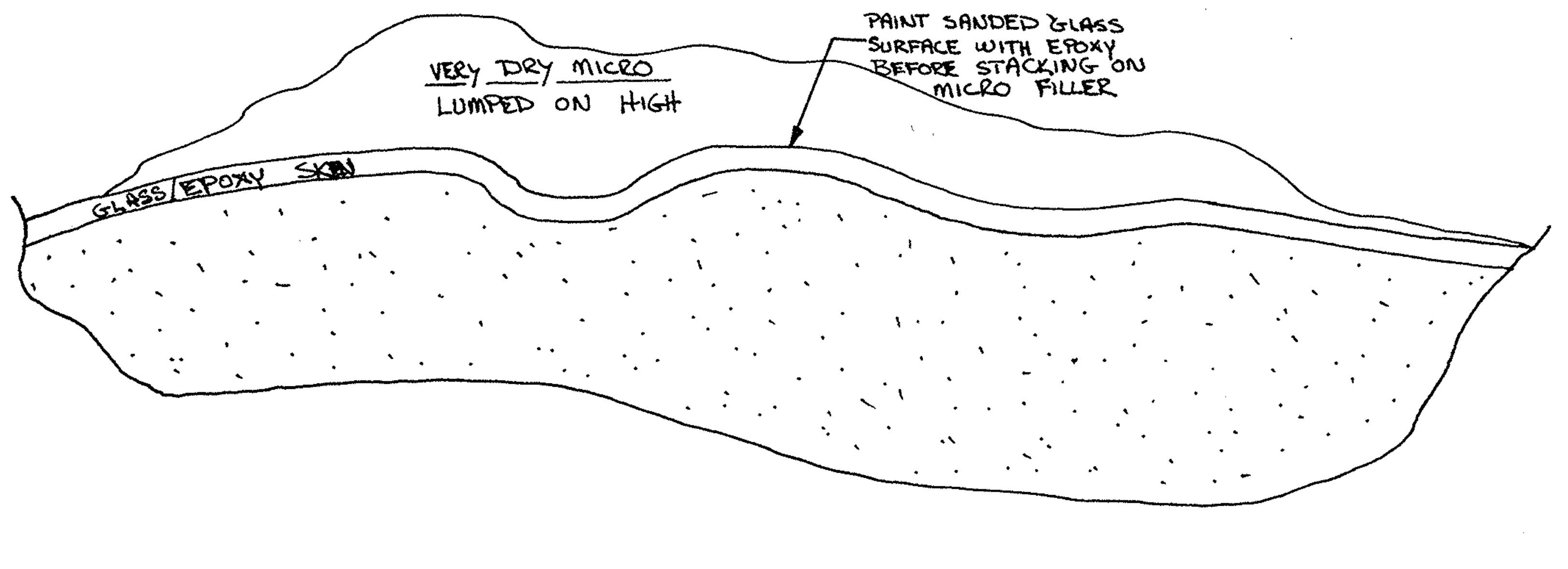

CHECK THE DEPTH OF DEPRESSION
IF OVER .03 INCH BUT UNDER .20 INCH FILL WITH DRY MICRO
RULER, YARD STICK, ETC.
UNDER .03 INCH USE FEATHER FILL
GLASS/EPOXY SKIN
FOAM CORE

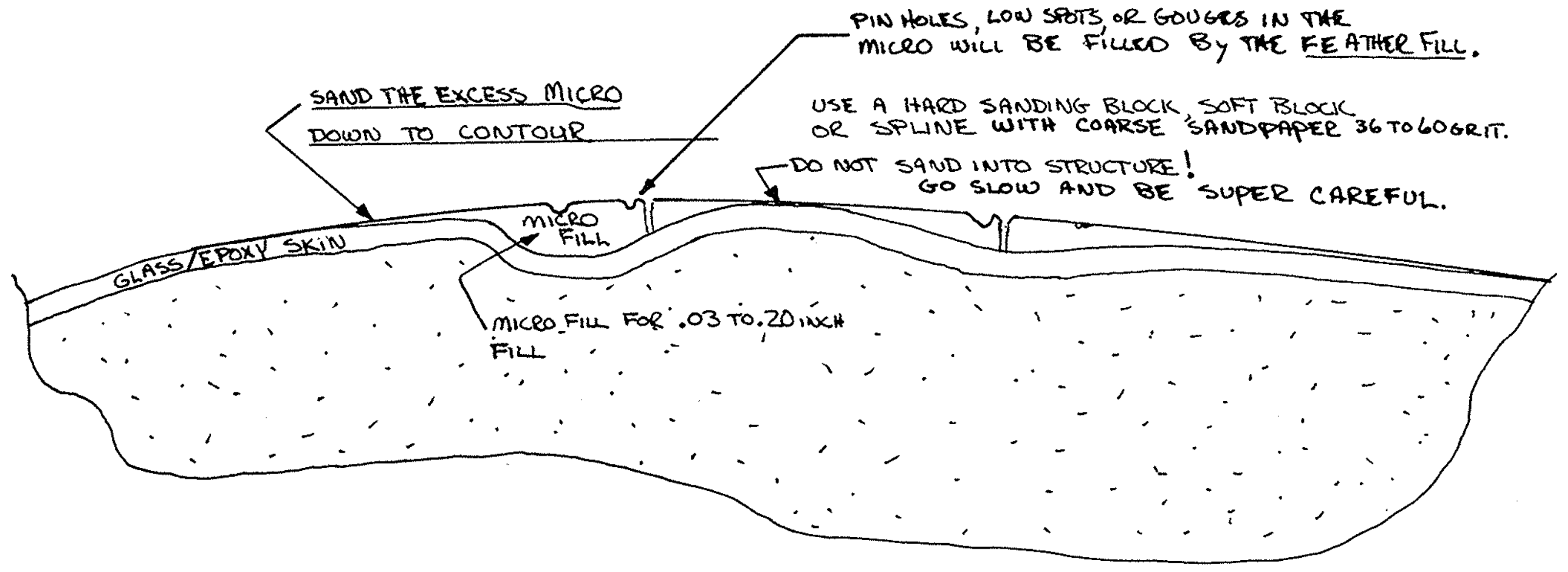

PREPARE THE AREA TO BE FILLED
SAND LIGHTLY WITH SANDPAPER HELD IN FINGERS
GLASS/EPOXY SKIN
YES
FOAM CORE

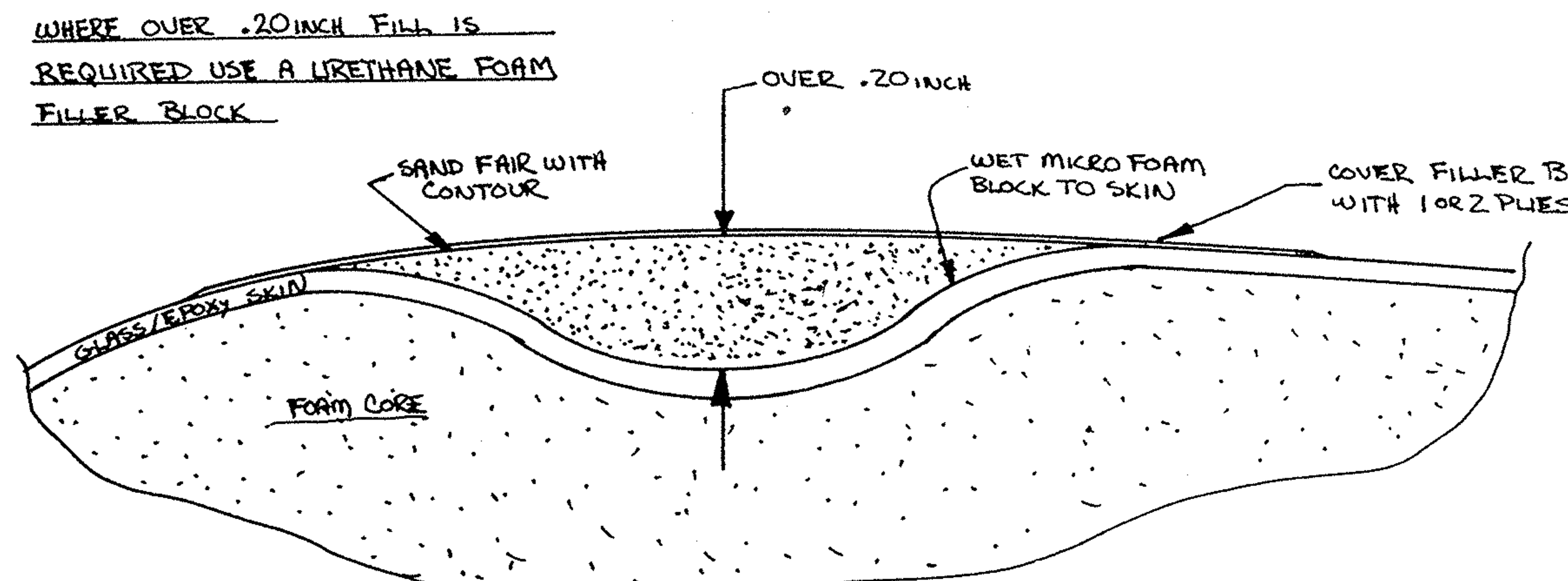


Paint a thin coat of epoxy over the area to be filled. Dry micro is then lumped over area. The fill must be high, such that material is sanded away to bring the area into contour. The micro should be mixed very dry (lots of Glass Bubbles to save weight). Let the micro cure at least 24 hours. Be sure to use Glass Bubbles, not microspheres with Safe-T-Poxy.

Sand the micro overfill into contour using a hard sanding block, or spline with coarse (36 to 60-grit) sandpaper. Exercise extreme caution while sanding. A few careless strokes with coarse paper can ruin your structure!


VERY DRY MICRO LUMPED ON HIGH
PAINT SANDED GLASS SURFACE WITH EPOXY BEFORE STACKING ON MICRO FILLER
GLASS/EPOXY SKIN


PIN HOLES, LOW SPOTS, OR GOUGES IN THE MICRO WILL BE FILLED BY THE FEATHER FILL.
SAND THE EXCESS MICRO DOWN TO CONTOUR
USE A HARD SANDING BLOCK, SOFT BLOCK OR SPLINE WITH COARSE SANDPAPER 36 TO 60 GRIT.
DO NOT SAND INTO STRUCTURE! GO SLOW AND BE SUPER CAREFUL.
MICRO FILL
GLASS/EPOXY SKIN
MICRO FILL FOR .03 TO .20 INCH FILL


WHERE OVER .20 INCH FILL IS REQUIRED USE A URETHANE FOAM FILLER BLOCK
OVER .20 INCH
SAND FAIR WITH CONTOUR
WET MICRO FOAM BLOCK TO SKIN
COVER FILLER BLOCK WITH 1 OR 2 PLIES BID.
GLASS/EPOXY SKIN
FOAM CORE

STEP III - Feather Fill

Sand the surfaces lightly by hand or with a soft foam sanding block in preparation for Feather Fill. A brush coat of Feather Fill will build up .02" to .03" thick, fill the glass weave and any medium size out of contour spots. Feather Fill will require several hours curing time before it can be sanded. The cured Feather Fill is sanded to contour using a spline or soft block and 100-grit sandpaper. Do not use 36-grit on Feather Fill. Again, extreme caution must be exercised not to damage the glass structure in pursuit of a good finish. The contouring must stop immediately when the highest glass peaks begin to be visible as the Feather Fill is sanded away.

If you find that you have underestimated the fill required or just have a thin coat, don't hesitate to use a second coat of Feather Fill. A well prepared surface generally won't need more than one coat. When you have finished contouring the Feather Fill, the surface should be basically smooth and fair. The primer to follow is not intended to be contoured heavily, just smoothed with finer sandpaper for a smooth finish while leaving a substantial ultra violet barrier. Be sure the surface is dry, dull and clean before using Feather Fill. Be sure the Feather Fill and shop area is at least 70° F.

Mix the catalyst with a paddle or wire on your electric drill motor. After mixing the catalyst, mix in about 25% by volume of micro balloons and brush on. Micro balloons make it go further, fill better and sand easier. Feather Fill catalyst is extremely dangerous to sensitive tissue. Use eye protection. A small amount in the eye can cause vision damage.

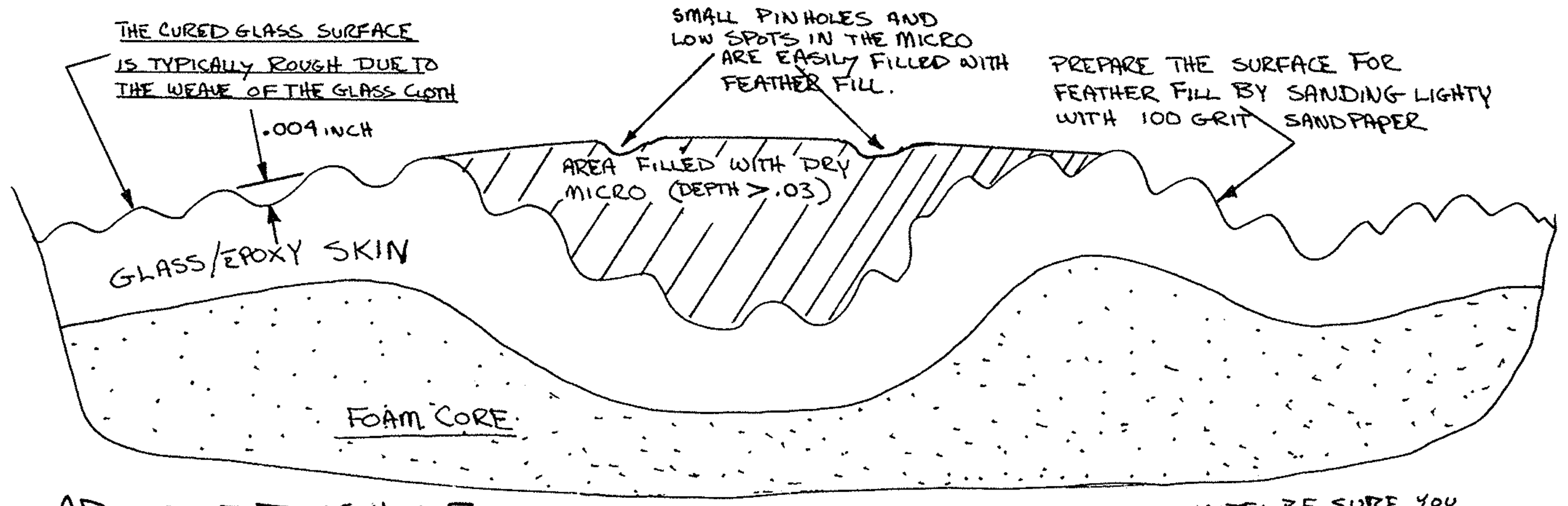
When finishing glass in preparation for Feather Fill, use coarse 36-grit paper, since Feather Fill requires a mechanical bond, not a chemical bond.

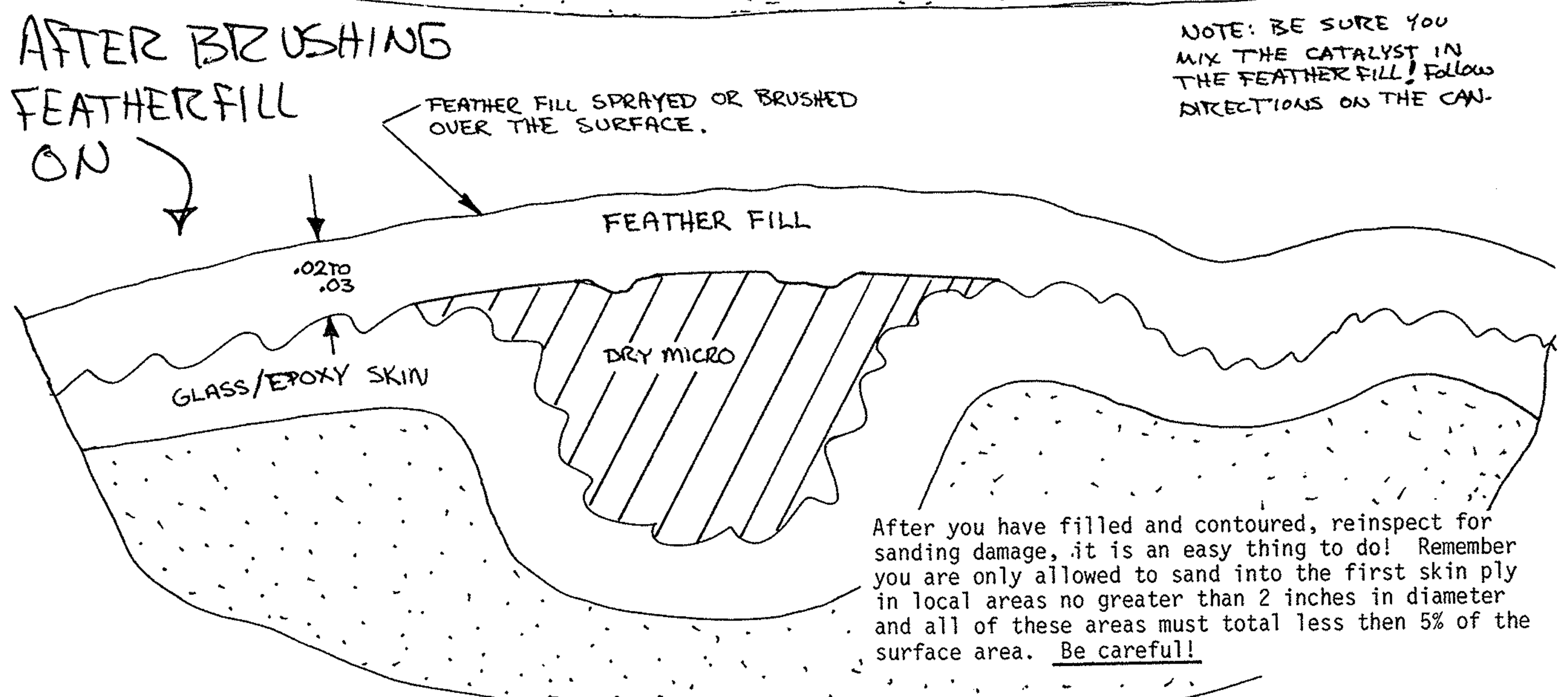
Do not wet-sand Feather Fill, it absorbs moisture. Feather Fill cannot be used over primer. 3M sanding screen type 18N FABRICUT WETORDRY silicone carbide 180 works excellently on Feather Fill. It is available at lumber yards.

Sterling is a two part urethane primer filler which can be used in place of Feather Fill. This product is more expensive than Feather Fill but it cures in about 45 minutes and has better adhesion properties. The product numbers of the Sterling are U1761 primer surfacer and U1762 catalyst. The reducer for slowing the cure or equipment cleanup is U1014. MEK can also be used for cleanups. Be very careful of urethane materials, breathing the fumes can be hazardous to your health. Use a N1OSH approved respirator and read the company bulletin on the use of this material. Mix the two part U1761 and U1762 in equal measure together, then add 30% by volume of micro balloons if you intend to spray the material, and up to 50% if you intend to brush it on.

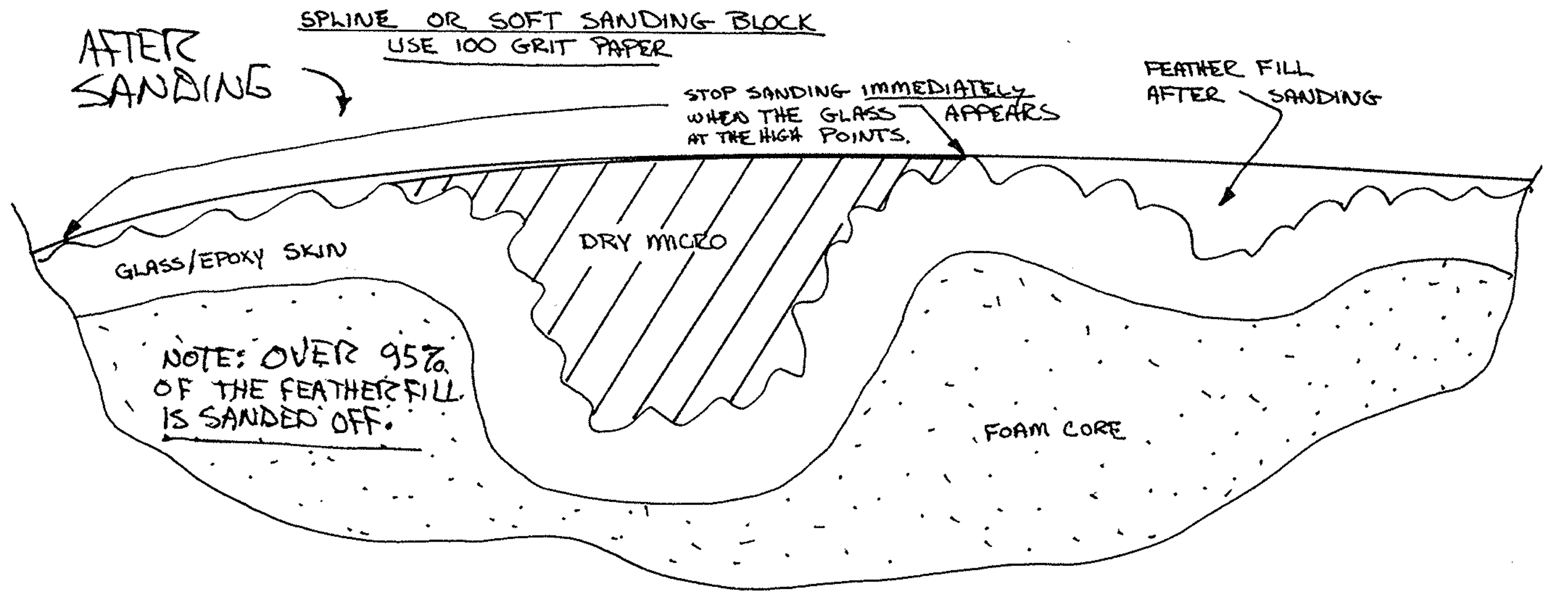
If you are spraying, it will probably be necessary to add about 10% reducer to slow the cure down. From the start of mixing you have about 15 minutes to apply the material and clean your equipment. We have successfully done this but most people will probably find it simpler to just brush the material on. Sanding for bond can be done with sandpaper 36-60 grit or 100-grit. This material will be ready to sand in about 45 minutes. As with Feather Fill do not apply this over primer. Sanding Sterling is the same as Feather Fill.

Morton Eliminator is a new polyester filler material that can be used in place of Feather Fill. This material has several advantages over Feather Fill. It can be wet sanded and does not have a problem when used in high humidity environments. Several of our builders have experienced problems when using Feather Fill in high humidity areas.


THE CURED GLASS SURFACE IS TYPICALLY ROUGH DUE TO THE WEAVE OF THE GLASS CLOTH
.004 INCH
SMALL PINHOLES AND LOW SPOTS IN THE MICRO ARE EASILY FILLED WITH FEATHER FILL.
PREPARE THE SURFACE FOR FEATHER FILL BY SANDING LIGHTY WITH 100 GRIT SANDPAPER
AREA FILLED WITH DRY MICRO (DEPTH > .03)
GLASS/EPOXY SKIN
FOAM CORE


AFTER BRUSHING FEATHERFILL ON
FEATHER FILL SPRAYED OR BRUSHED OVER THE SURFACE.
NOTE: BE SURE YOU MIX THE CATALYST IN THE FEATHER FILL! Follow DIRECTIONS ON THE CAN.
FEATHER FILL
.02 TO .03
GLASS/EPOXY SKIN
DRY MICRO

After you have filled and contoured, reinspect for sanding damage, it is an easy thing to do! Remember you are only allowed to sand into the first skin ply in local areas no greater than 2 inches in diameter and all of these areas must total less then 5% of the surface area. Be careful!


CONTOUR THE FEATHER FILL USING A SPLINE OR SOFT SANDING BLOCK USE 100 GRIT PAPER
AFTER SANDING
STOP SANDING IMMEDIATELY WHEN THE GLASS APPEARS AT THE HIGH POINTS.
FEATHER FILL AFTER SANDING
GLASS/EPOXY SKIN
DRY MICRO
NOTE: OVER 95% OF THE FEATHERFILL IS SANDED OFF.
FOAM CORE

Morton Eliminator also has the ability to fill pinholes in the first application better than anything else we have used. To use it, follow the directions on the can. After spraying on the first coat, you will be able to see any existing pinholes. Use a soft squeegee and squeegee the fresh sprayed material into the pinholes, then apply a second spray coat. Let this cure. After cure, sand with 100 grit and if necessary recoat and the material can be sanded to 180 grit. This will cut down on the amount of primer to one coat, sanding with 320 then 400.

A note of caution, we have used each of these materials separately but not on the same project. It is possible to compoind finishing problems by using a multitude of materials on one project. Picking one of the fillers and using it throughout would be sound judgement.

After you have filled and contoured, reinspect for sanding damage, it is an easy thing to do! Remember you are only allowed to sand into the first skin ply in local areas no greater than 2" in diameter and all of these areas must total less than 5% of the surface area. Be Careful!

STEP IV - Primer

The ultra violet radiation barrier is provided by the dried primer. The primer gives the whole surface a dark grey color and the sanding should never remove it completely, exposing the filler material below. The primer is sprayed on, allowed to dry and sanded lightly to achieve a smooth surface. The first primer coat is sanded using 220-grit and the second coat very lightly wet-sanded with 320-grit and then lightly finished with 400-grit or according to the recommendation of the paint manufacturer. When complete, the primer is very smooth, dark and ready for finish paint. Inspect for imperfections or pinholes. Fill pinholes with lacquer spot putty (in a tube) and sand. Spot spray with primer and resand.

STEP V - Finish Paint

Follow the manufacturer's directions for the type of finish paint that you have chosen.

MISCELLANEOUS

Seals - Where a flexible seal between two assemblies is required, white silicone rubber (RTV) is recommended. For a removable seal such as between the wing root and fuselage or canard and fuselage, one side of the seal is bonded to the part and the other side is treated before application of the sealant so that it can't adhere. A simple release can be achieved by taping Saran Wrap tightly over one side of the joint. The seal is installed by assembling the two components with Saran Wrap protecting one side, lightly sanding the other and then wiping the wet silicone into the gap. Remove all excess silicone at the surface. This assembly has to dry for at least two days before the parts are disassembled. The Saran Wrap will easily peel off the cured silicone.

Cockpit Interior Paint

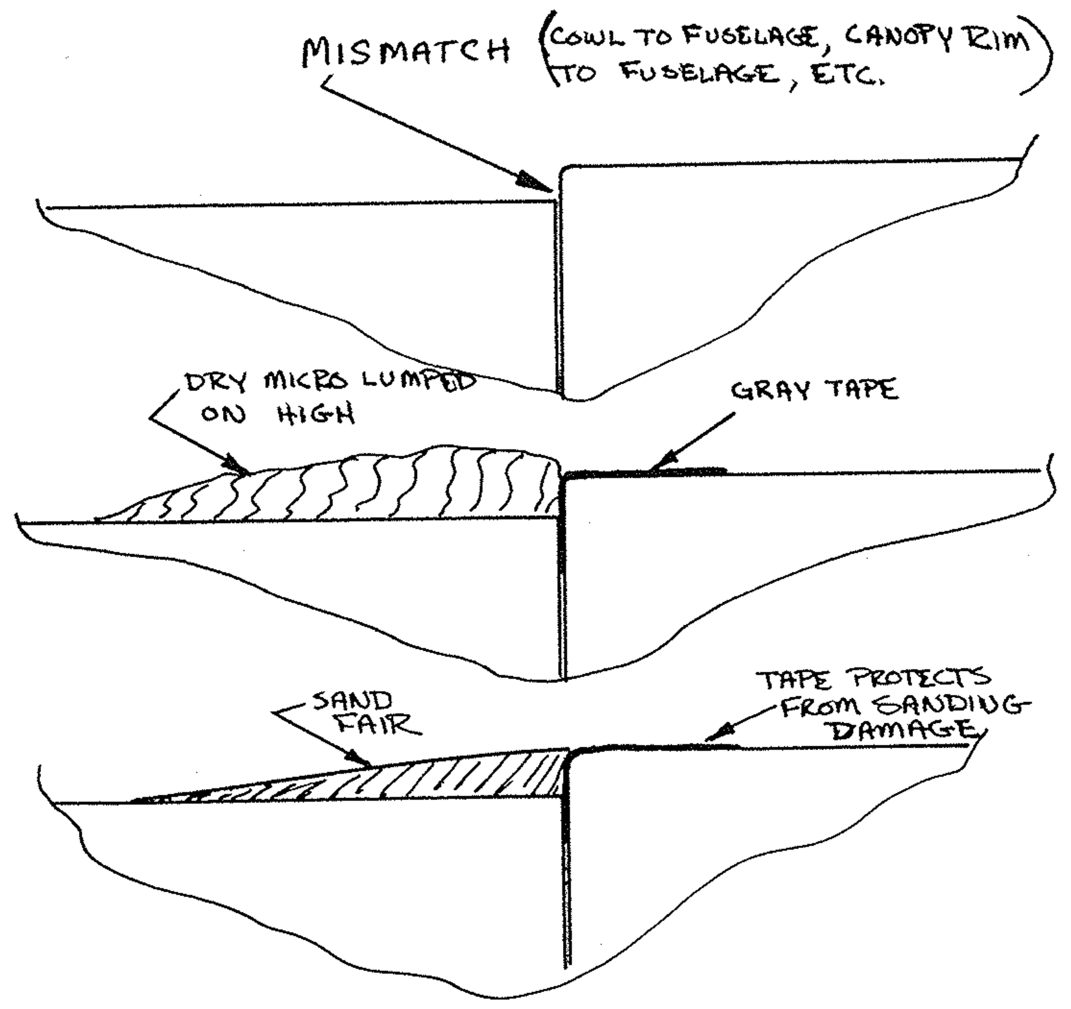
You may use colored cockpit paint to suit your own taste. The prototype. Defiant N78RA was painted with Zolitone charcoal. This material is a speckle paint and does an excellent one coat job of finishing the interior of the aircraft. We have not found it necessary to use a primer. Lightly sand the interior with 80-grit sandpaper and spray it on according to the directions on the can. Most other types of paint are acceptable, however they will require a primer undercoat. Do not fill the weave as this will just add unnecessary weight. A light color in the cockpit will help avoid heat buildup with the canopy closed in the summer.

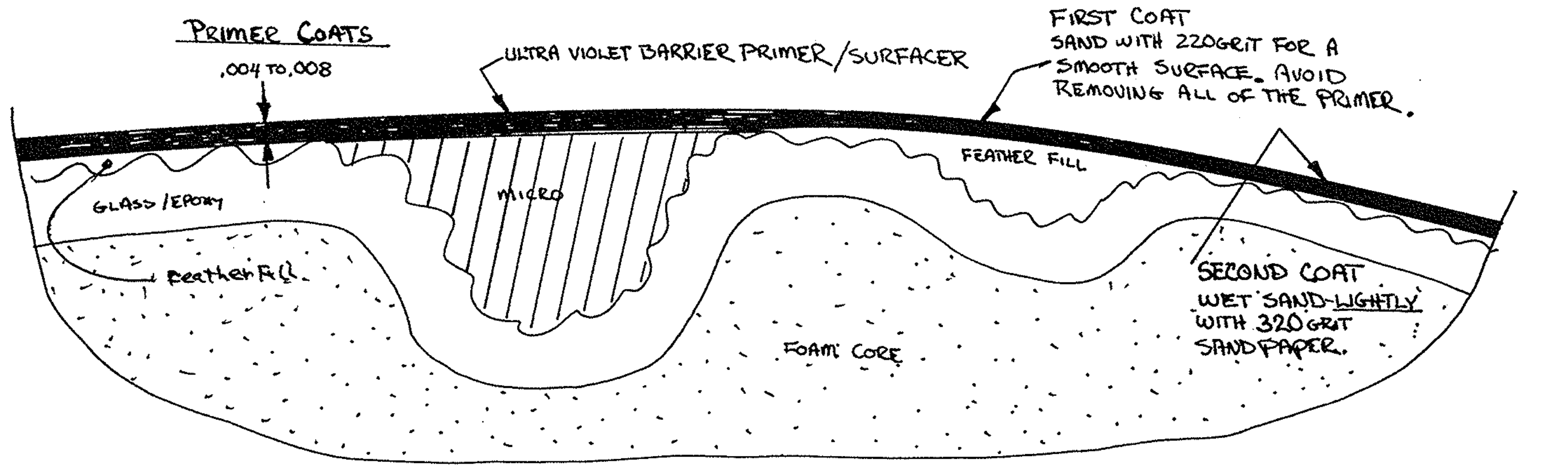
N- Numbers - (Registration Marks)

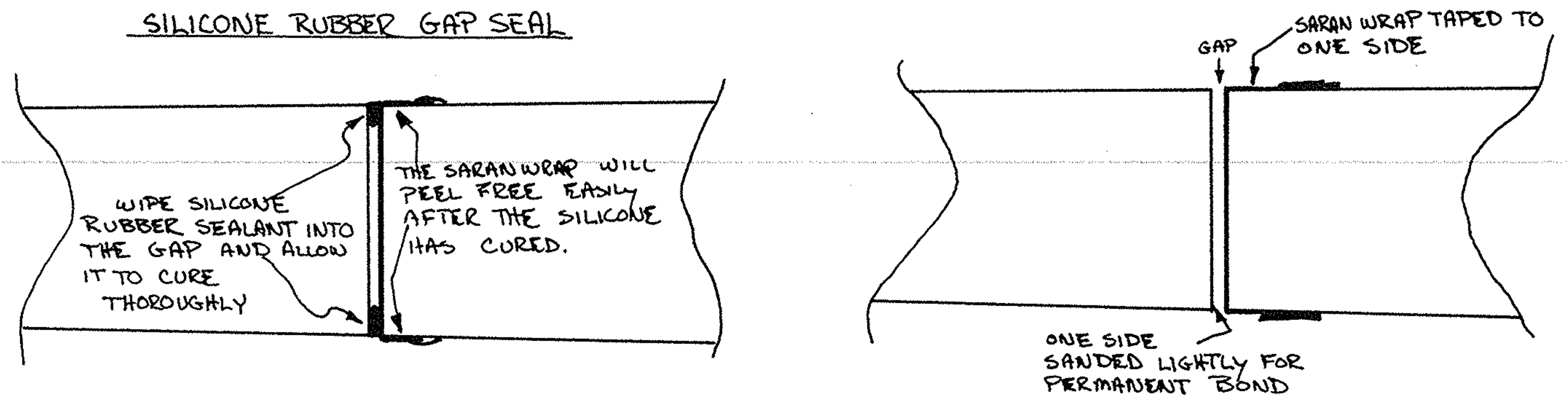
You may use adhesive type letters and numbers or paint your registration marks directly on the airplane; your choice. Some simple hints may save some trouble on either method. When installing the self-adhesive tape, first use Windex window cleaner to wet the area where you want the markings, strip the protective backing off the letter or number and apply it to the wet surface. The Windex will allow you to slide the markings around for perfect positioning and then when located properly, just press them down lightly. The pressure squeezes the Windex out and allows the adhesive to bond to the airplane. If you paint the registration marks directly onto your airplane, first mask off the outlines for painting. Then sand lightly with 400-grit sand paper and paint. Remove the masking tape.

TRIM PAINT ON LIFTING SURFACES

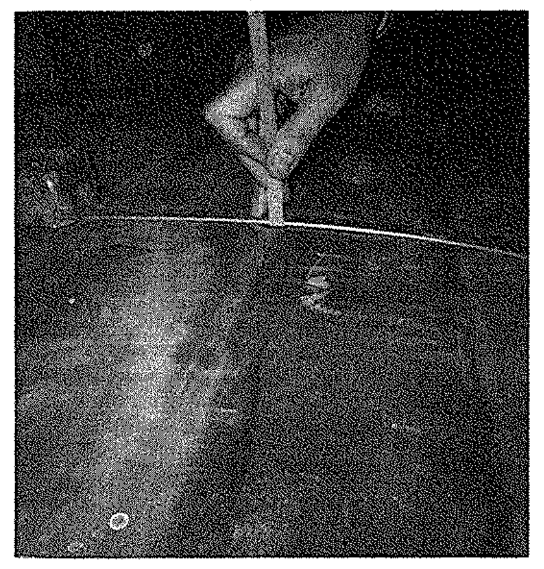
The lifting surfaces of the Defiant are designed to have a certain amount of "laminar flow". This is air flow which is smoothly flowing across the airfoil. This allows maximum performance of the airfoils and the measured performance of the Defiant was taken with the normal amount of laminar flow on the airfoils. If your aircraft is to meet the performance of the prototype, you must not disrupt this laminar flow. Any step or bump of .005 or more aft of 4% chord will trip the laminar flow behind it. A paint stripe spanwise along the wings or canard will disrupt the proper air flow. We have removed all the laminar flow from the Defiant for testing and though the aircraft has no problem with flight control the performance of the aircraft was degraded. Keep paint stripes at the top of both the wing and canard and run paint stripes chordwise to avoid this problem.


MISMATCH (COWL TO FUSELAGE, CANOPY RIM TO FUSELAGE, ETC.)
DRY MICRO LUMPED ON HIGH
GRAY TAPE
SAND FAIR
TAPE PROTECTS FROM SANDING DAMAGE


PRIMER COATS
.004 TO .008
ULTRA VIOLET BARRIER PRIMER/SURFACER
FIRST COAT SAND WITH 220 GRIT FOR A SMOOTH SURFACE. AVOID REMOVING ALL OF THE PRIMER.
FEATHER FILL
GLASS/EPOXY
MICRO
Feather Fill
FOAM CORE
SECOND COAT WET SAND LIGHTLY WITH 320 GRIT SANDPAPER.

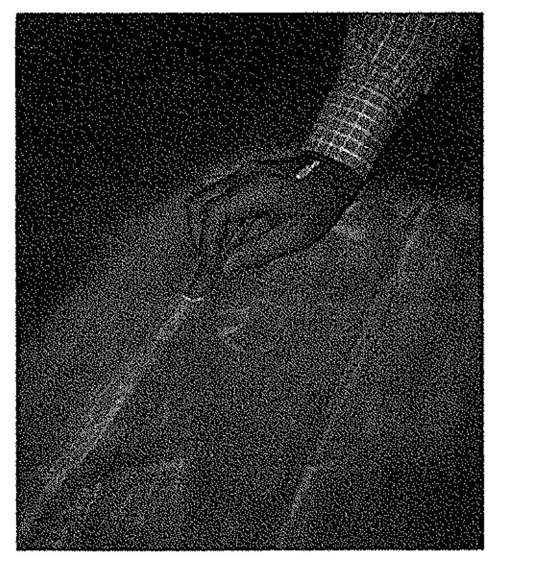

SILICONE RUBBER GAP SEAL
WIPE SILICONE RUBBER SEALANT INTO THE GAP AND ALLOW IT TO CURE THOROUGHLY
THE SARAN WRAP WILL PEEL FREE EASILY AFTER THE SILICONE HAS CURED.
GAP
SARAN WRAP TAPED TO ONE SIDE
ONE SIDE SANDED LIGHTLY FOR PERMANENT BOND

①



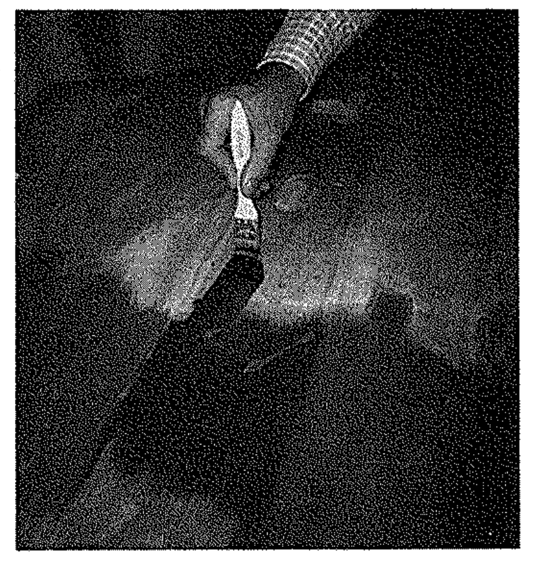
CHECKING DEPRESSION DEPTH FOR DRY MICRO FILL

②



HAND SANDING IN PREPARATION FOR DRY MICRO FILL

③

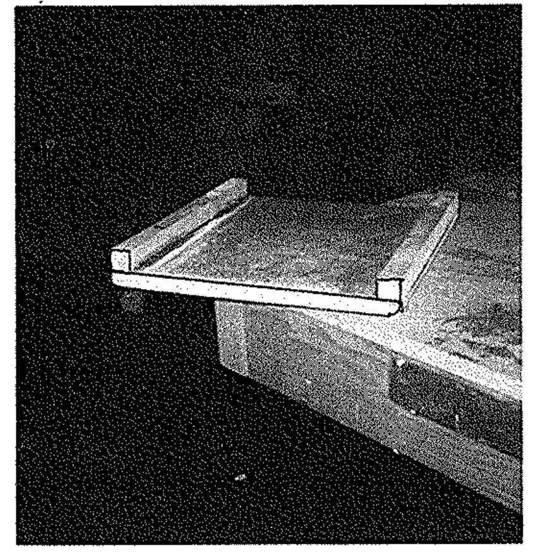


PAINTING ON A LIGHT COAT OF EPOXY

④

TROWEL ON A GENEROUS LAYER OF DRY MICRO

⑤

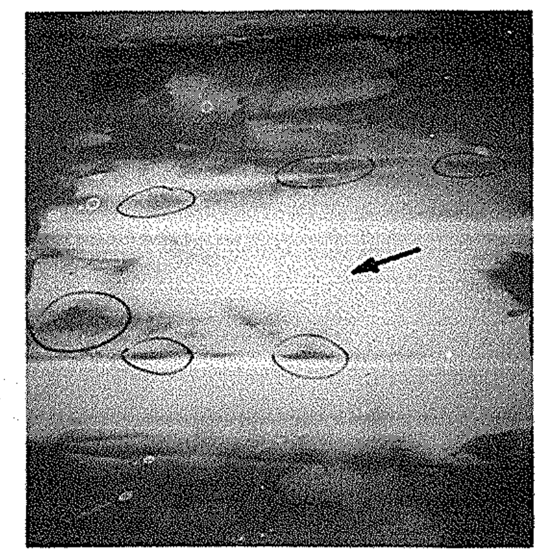


THE SANDING SPLINE

⑥

USING THE SPLINE TO ROUGH CONTOUR THE CURED DRY MICRO.

⑦

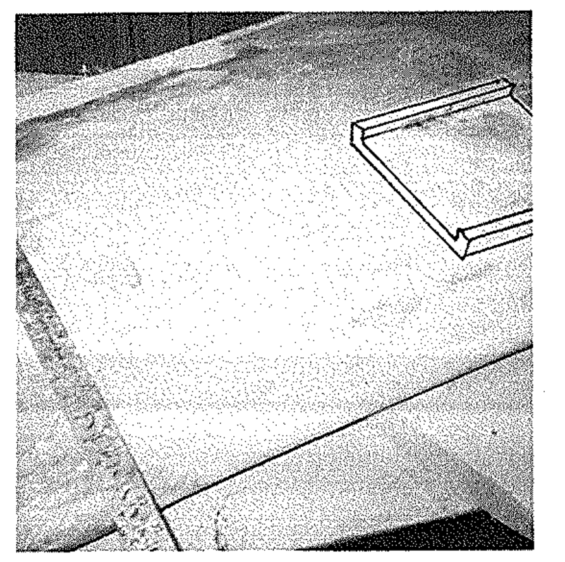


THE SANDED SURFACE. THE CIRCLED AREAS ARE GLASS PEAKS BEGINNING TO APPEAR.

⑧

BRUSHING ON FEATHER FILL OR STERLING OR MORTON'S ELLIMINATOR

⑨



FEATHERFILL AFTER SPLINING WITH 100 GRIT SANDPAPER.